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ABSTRACT

As part of the overall goal of the Environmental Protection Agency (EPA) to help provide environmental professionals with the skills required to plan and deliver training programs, this participant reference manual, and its related staff guide, have been developed for conducting a workshop in basic instructional technology. The workshop consists of 12 units totalling approximately 25-35 hours of classroom time if the entire course is presented. Each unit includes an overview, unit lessons (with the corresponding learning activities), and lists of objectives and resources needed for the lessons. The emphasis of the units is on the development of the basic, practical skills of: identifying instructional needs; specifying objectives; planning instruction; locating support materials; conducting instruction using various formats and effective speaking techniques; and evaluating the performance of those who receive the instruction. Most of the content is treated on a strictly applied basis with a minimum of theory and technical explanations. Instructional activities include lectures, guided discussions, demonstrations, individual assignments, and readings. Materials in appendices include references, a glossary, and a description of other United States EPA instructional support services and materials. (JN)

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PARTICIPANT REFERENCE MANUAL

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FOREWORD

In 1970, in response to an urgent need for instructors in wastewater treatment plant operations, the U.S. Environmental Protection Agency initiated an Instructor Training Program. The initial "basic" course was developed by Kenneth M. Hay, Education Specialist in the Office of Water Programs. It was designed for persons experienced in plant operations who expected to be training others but who had had no training in instructional methodology and techniques. Course content was continually reviewed and modified as needed, based on experience gained by its presentation to hundreds of novice trainers throughout the country. Some of the training materials were formalized (via a grant) into a staff guide to assist others in similar training efforts.

The Instructor Training Program was later expanded to include an "advanced" workshop for individuals who had completed the basic course and had some experience as instructors, but who needed more background and practice in developing instructional programs. Training materials were developed and several area workshops were conducted with grant funds.

In order to consolidate all the materials resulting from the extensive experience in offering this training, EPA's National Training and Operational Technology Center awarded a contract to Development and Evaluation Associates, Incorporated, of Syracuse, New York. The contractor revised, integrated, and expanded the existing materials to produce complete Staff Guides (including Transparency Masters), and Participant Reference Manuals for 1) a Basic Instructional Technology workshop and 2) an Advanced Instructional Technology workshop. The project was completed in September, 1979.

In FY 1980, NTOTC awarded eleven grants for support of eight Basic IT workshops, three Advanced IT workshops and one combined Basic and Advanced workshop to be conducted by staffs using the support materials. Grantees were to submit evaluations and suggestions for finalization of these materials. The last of these workshops was presented in January, 1981. One of the grantees submitted a proposal to undertake the finalization project, based on the reports from the field tests. Subsequently, a grant was awarded to Utah Technical College at Provo for this project.

The field test data was analyzed and incorporated into the final product. The revised manuals were reviewed by staff of the College of Education, Utah State University. The project was completed in June, 1982.

Pre-Workshop Survey

PRE-WORKSHOP SURVEY

Name ______________________________ **Occupation**______________________________

1. Reason for taking this workshop:

2. Indicate your teaching experience?

   ___ 0-1 year ___ 1-3 years ___ 3-5 years ___ over 5 years

   Describe your teaching assignment.

3. Do you know how to operate any audio-visual equipment?

   ___ 16mm projector ___ overhead projector

   ___ 35mm projector ___ video playback machine

4. Have you ever developed instructional/training materials or designed a workshop?

   ___ yes ___ no

   Please describe your experience in this area.

5. Have you ever created and used tests and rating scales or planned and carried out an evaluation of employee job performance?

   ___ yes ___ no

   Explain:

6. What do you see as the most important training need in your work setting for youself or others?

Thank you for your help.

UNITS OF INSTRUCTION

BASIC INSTRUCTIONAL TECHNOLOGY

UNIT ONE
INTRODUCTION - Unit Overview

Overview:

The explicit purpose of this unit is to introduce the workshop and explain its focus on a systematic approach to instruction. As a means of improving instructional effectiveness, the unit begins with participant introductions and brief presentations of personal experiences with good and bad instruction. The secondary purpose of this exercise is to encourage participants to speak before a group.

Objective:

LESSON 1: Workshop participants will describe several qualities of good instruction from memory or from notes. Each participant will give at least two examples and explain them to a group.

LESSON 2: Participants will explain, from memory, that the purpose of this workshop is to learn to plan instruction systematically using the Instructional Package Worksheet, taking into account individual student needs.

LESSON 3: Participants will list the four phases of a systematic approach to instruction and the tasks included in each.

Resources:

LESSON 1: -Assign. 1.1 - Qualities of Instruction Note Sheet

LESSON 2: -Content Summary
-Instructional Package Worksheet

LESSON 3: -Content Summary

UNIT ONE: INTRODUCTION
LESSON 1 of 3: INTRODUCTION TO THE QUALITIES OF GOOD INSTRUCTION

Assignment 1.1: Qualities of Instruction Note Sheet

Directions:

You will be asked to stand and speak to the group about the qualities of good instruction. You might talk about what you think is involved in good teaching, what results in bad teaching, etc. You may wish to give examples of both good and bad instruction from your own experiences as a learner. Use this sheet to jot down any notes which might help you with your presentation.

"Good" Instruction	"Bad" Instruction

UNIT ONE: INTRODUCTION
LESSON 2 of 3: THE PURPOSE OF THIS WORKSHOP

Content Summary

INSTRUCTIONAL PACKAGE WORKSHEET EXPLANATION

CURRICULUM (TITLE)

COURSE (TITLE)

UNIT (NUMBER): (UNIT TITLE)

LESSON: (NUMBER OF TOTAL NUMBER OF LESSONS IN UNIT):
(LESSON TITLE)

Estimated time: (Range of minutes to complete lesson.)

Entering Competencies:	(Previous skills/knowledge needed to begin this lesson.)
Justification:	(Statement explaining the importance of the lesson and the value of the skill/knowledge to be gained.)
Objective:	(What behavior the participants as trainees will demonstrate, under what conditions, and with what degree of performance.)
Evaluation Activities:	(The method or methods by which learners' successful completion of the lesson objectives is measured.)
Resources:	(Support materials used by the instructor during the lesson.)
Instructional Approach:	(Description of the sequence of activities through which the trainees will gain mastery of the objective stated in terms of what the instructor will do.)

UNIT ONE: INTRODUCTION
LESSON 2 of 3: THE PURPOSE OF THIS WORKSHOP

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM:

COURSE:

UNIT:

LESSON:

Estimated time:

Entering Competencies:

Justification:

Objective:

Evaluation Activities:

Resources:

Instructional Approach:

UNIT ONE: INTRODUCTION
LESSON 3 of 3: SYSTEMATIC APPROACH TO INSTRUCTION

Content Summary

This workshop will show how to plan effective training according to the following model.

Phase One: ANALYSIS

1. Define the problem.
2. Analyze the tasks.

Phase Two: DESIGN

3. Specify instructional objectives.
4. Determine evaluation activities.

Phase Three: DEVELOPMENT

5. Select instructional methods and media.
6. Develop instructional strategies.

Phase Four: DELIVERY

7. Deliver instruction.

UNIT ONE: INTRODUCTION
LESSON 3 of 3: SYSTEMATIC APPROACH TO INSTRUCTION

Assignment 1.2 - Unit One Review

Directions:

Please answer the following questions. Your answers will be used as part of the class discussion to follow.

1. List two characteristics of good instruction.

2. Good instruction requires a ______________________ approach.

3. List the four phases of the systematic approach to instruction, including tasks under each phase.

UNIT TWO
MANAGEMENT OF INSTRUCTION - Unit Overview

Overview:

No matter how well planned and prepared the instructor, failure to consider and control certain variables in the classroom environment can severely lessen the effectiveness of instruction. This unit introduces variables in the physical and interpersonal environment the instructor should consider in planning a class. Techniques for managing the class and maintaining attention are also described.

Objectives:

LESSON 1: In a guided discussion, participants will draw upon their personal experiences and identify important variables in the physical and interpersonal environment of the classroom and predict the impact of at least one variable upon instructional effectiveness. In general discussion, each participant will describe and provide an example of at least one technique for managing the class and maintaining attention.

LESSON 2: Given a list of both ineffective and effective oral presentation techniques and mannerisms, participants will separate those which increase presentation effectiveness from those which decrease or prevent effectiveness.

LESSON 3: Given sample questions, participants will analyze and correct any errors, demonstrating principles taught in this lesson.

Resources:

LESSON 1: -Content Summary

LESSON 2: -Content Summary

LESSON 3: -Content Summary

UNIT TWO: MANAGEMENT OF INSTRUCTION
LESSON 1 of 3: CLASSROOM MANAGEMENT

Content Summary

I. Introduction

A. Background information concerning students and training location must be taken into account during the entire instructional development process. Ignoring these facets can doom a training exercise to failure.

B. Environmental influences on instruction are illustrated by a simple model of the process of instructional communication. The environment may either change the instructional message before it reaches the learner or affect the learner's ability to receive it.

C. Two major kinds of environmental influence may impact instructional communication.

1. Physical environment - the setting for the instruction.

2. Psychological environment - the learner's attitudes and dispositions toward the instruction or the setting.

II. Environmental Effects on Communication

A. Effects of physical environment on communication.

B. Effects of the psychological environment on communication.

III. Techniques for Overcoming Problems with the Physical or Psychological Environment

A. Things to consider in planning instruction.

1. Selecting instructional methods and media to accommodate the physical environment.

2. Developing rewards for motivating students.

3. Planning the teaching schedule to allow for breaks, question periods, etc.

4. Determining the degree of formality or informality you wish to maintain in the classroom.

B. Techniques for managing the class and maintaining attention.

   1. Introduce the class by explaining what is to be taught and outlining the instruction. Explain how it meets the needs/interests/background of the learners.

   2. Keep learners informed of progress through the intruction (i.e.. "the second point that must be explained...", "the last exercise for today...").

   3. Keep attention focused on key (i.e.. "what's important here is..."). Use media or graphic techniques to highlight points.

   4. Maintain high levels of learner participation in the instruction.

      a. Frequent questions and exercises.

      b. Use of instructional methods other than the lecture (i.e. seminars, games and simulations, group discussion, field experiences, videc tapes and movies, etc.).

   5. Pace the instruction appropriately for the particular group of learners. Use a variety of instructional media and methods.

   6. During lectures, move closer to the class and/or move around the room if attention is slipping. Stand closest to, or lecture at, those who appear to be falling asleep.

7. Counsel "problem" or disruptive learners outside of class.

8. Be fair and considerate to all members of the class.

C. Practical classroom tips.

1. Use the lesson plan. Changing horses in midstream will confuse the learners.

2. Don't talk too much and dominate a guided discussion session.

3. Divide theoretical talks into small segments.

4. Allow frequent breaks.

5. Insure the room and furniture are comfortable.

6. Arrange the furniture to fit your needs prior to the trainees' arrival.

7. Insure the room and furniture are clean and free from clutter.

8. Disseminate handout materials before or after class to cut down on wasted class time.

9. Provide all materials that will be referred to during the session.

10. Try out training aids before the class begins and have projectors loaded or threaded.

11. Pre-draw or sketch on the chalkboard.

12. Eliminate distractions.

UNIT TWO: MANAGEMENT OF INSTRUCTION
LESSON 2 of 3: PRESENTATION MANAGEMENT

Content Summary

I. Rules for Effective Oral Presentations

A. Oral presentations must be spoken, not read.

1. Maintain eye contact with the audience.

2. Use humor to establish and maintain rapport with the audience.

3. Use a variety of voice tones and volumes.

4. Create an atmosphere of informality by appearing relaxed.

5. Use language that is appropriate for the audience.

6. Check frequently to determine degree of audience interest and understanding.

7. Allow space for occasional questions and comments from the audience.

8. Show enthusiasm for the topic.

B. The speaker's body must not distract from the content of the presentation.

1. Be poised; do not pace around, shuffle feet or papers, or wave hands.

2. Avoid talking to the audience while facing a blackboard or when using other media.

3. Reduce unnecessary and distracting hand and body movements.

C. The presentation must be organized and logical.

1. Orient the audience to the topic to provide motivation for listening.

2. Inform the audience of the structure of the presentation.

3. Emphasize major points using media as appropriate.

4. Summarize major points at the end.

UNIT TWO: MANAGEMENT OF INSTRUCTION
LESSON 3 of 3: QUESTIONING TECHNIQUES

I. Introduction

  A. Questions as an aid to the student.

    1. Alert him to the main points.

    2. Require his participation.

    3. Reinforce his learning.

  B. Questions as an aid to the instructor.

    1. Serve as a participation technique.

    2. Act as a feedback mechanism.

    3. Are useful as a class control technique.

II. Uses of Questions

  A. During the introduction to:

    1. Gain attention.

    2. Start the audience thinking,

    3. Orient on the subject.

  B. During the presentation to:

    1. Emphasize points.

    2. Gain participation.

    3. Acquire feedback.

  C. At the end of the presentation to:

    1. Obtain feedback.

    2. Clarify points not understood.

    3. Insure learner has achieved desired performance level.

III. Characteristics of Good Questions

A. Specific as to requirement. (It has one specific purpose.)

B. Discourages guessing.

C. Is understood by the students.

D. Is not multi-barrelled; emphasizes one point.

E. Does not suggest the answer.

F. Requires a definite answer.

G. Encourages analysis and synthesis by learner.

IV. Proper Techniques for Answers

A. In asking questions, the question should usually be posed to the audience as a whole, there should be a pause until all have had a chance to think of the answer, and an individual should be called upon by name. A class roster should be available unless the instructor knows the members of the class or there are names on the desks. Sometimes a question asked of a specific individual may be of use.

B. When an instructor answers a question in class, he should insure the whole class knows the question asked. If necessary, the instructor should repeat the question and perhaps rephrase the question if appropriate. The instructor has several options at this point.

1. He may answer the question.
2. He may relay the question to another class member.
3. He may put the question back to the questioner.
4. If a class member answers a question, the instructor should insure all have heard the reply. The instructor must insure the answer given to the audience is correct and the discussion is continued until the correct answer evolves and is identified as the correct answer.
5. Some questions have several acceptable or "correct" answers.

V. Instruction Questioning Techniques

A. Good questions and techniques are essential to good instruction.

B. Questions gain attention, make the audience think, and highlight the main points.

C. Questions benefit both student and instructor by providing feedback and participation.

D. The proper technique is usually to pose the well developed question, pause, and then call on a student to answer.

E. In answering questions from the class, the instructor should insure the class knows both question and answer.

F. Questions strengthen learning in many ways but most importantly by increased learner participation.

UNIT THREE
PROBLEM ANALYSIS - Unit Overview

Overview:

Effective training must be designed to address a specific, well-defined problem. This unit introduces workshop participants to a systematic approach to the analysis of personnel performance problems.

Objectives:

LESSON 1: Given typical problem situations, participants will describe why problem analysis is an integral part of in-plant and classroom training for both continuing and prospective operators.

LESSON 2: Given sample problem statements, participants will explain why each statement is adequate or inadequate.

LESSON 3: Given sample problems, the participants will assign a problem to the (1) skill or knowledge, (2) motivation or incentive, or (3) environmental problem categories.

Resources:

LESSON 1: -None

LESSON 2: -None

LESSON 3: -Content Summary
-Assign 3.1 - Categories of Problems

UNIT THREE: PROBLEM ANALYSIS
LESSON 3 of 3: CATEGORIES OF PROBLEMS

Content Summary

I. Definition

Problem: A discrepancy or deficiency between the way things are and the way things ought to be.

II. Categories

A. Skill or knowledge problems - ones in which people do not know what to do or how to do it. They may want to perform a task but they simply do not have the training for it. These are the problems for which training solutions are best indicated.

B. Motivation or Incentive Problems - cases where, for some reason or reasons, people do not want to perfom the task. They may know how to do it. In these cases, putting them through a training program will usually not solve the problem.

C. Environmental Problems - typically cases in which the organization or working environment is hindering effective performance. These problems are usually not training problems. Many times they are management problems.

UNIT THREE: PROBLEM ANALYSIS
LESSON 3 of 3: CATEGORIES OF PROBLEMS

Assignment 3.1 - Categories of Problems

Directions:

Read the following problem definitions and write the correct problem category (skill or knowledge, motivation or incentive, or environmental) in the line following each statement. Put a check mark in front of each problem which can be corrected through training.

1. The newly hired operator used too heavy a lubricant on the sludge pump.

____

2. Missing barricades were not replaced, so the crew set up five barricades instead of the eight which were required for the job.

____

3. The operator was concerned that his effluent had deteriorated when he faithfully wasted sludge from the clarifier every evening until it ran clear.

4. The treatment plant consistently met the effluent standards during the year and the operators were understandably proud of their accomplishment. However, the effluent quality is erratic this year. The design engineer is confused since the effluent quality started its decline the same month he so graciously accepted the "Best Operator" award for this same plant.

____

5. A new comminutor was installed at the plant to replace a worn barminutor. Although spare parts are available and the operators try hard to keep it in running order, it seems to be out of commission a good deal of the time. (The comminutor isn't a lemon).

____

Turn the page and correct your own assignment.

Self Check of Assignment 3.1

(checked) 1. Skill or knowledge.

2. Environmental.

(checked) 3. Skill or knowledge.

4. Motivation.

(checked) 5. Skill or knowledge.

UNIT FOUR
TASK ANALYSIS - Unit Overview

Overview:

To design training relevant to a job-related problem, it is first necessary to identify all the component tasks of that job. This unit introduces the process of analyzing a job to define its tasks at various levels of detail. Workshop participants will learn to match the tasks to the appropriate type of learning required for their performance.

Objectives:

LESSON 1: Given the concepts "job", "job description", "task" and "task analysis", the participant will give a description of each which paraphrases the definitions given in the lesson.

LESSON 2: Participants will match the different types and levels of behavior to specific tasks in Assign. 4.2.

Resources:

LESSON 1:
- Content Summary
- Assign. 4.1 - Definition Review

LESSON 2:
- Content Summary
- Assign. 4.2 - Types and Levels of behavior

UNIT FOUR: TASK ANALYSIS
LESSON 1 of 2: INTRODUCTION TO JOB ANALYSIS

Content Summary

I. Definition of Terms

A. A "job" is the occupational title or position held by an employee.

B. A "job description" is a statement (or statements) outlining areas of responsibility (duties) of a given position.

C. A "task" is one of the skills or operations which belong to a specific duty. Each task usually consists of specific and distinct steps for its completion.

D. "Task analysis" is the act of dividing a duty into all of its component tasks. It results in a list of everything an employee must do to advance the work to completion.

Example:

Job Title: Collection Crew Foreman

Duties:

- A. Repair lines.

  Tasks:
  - 1. Locate line.
  - 2. Set up safety equipment.

    Steps:
    - a. Re-route traffic.
    - b. Position barricades.
    - c. Position flagmen.
    - d. etc.
  - 3. Trench.
  - 4. Shore, if necessary.
  - 5. Determine Repair method
  - 6. etc.
- B. Lay new lines.
- C. Clean lines.
- D. etc.

UNIT FOUR: TASK ANALYSIS
LESSON 1 of 2: INTRODUCTION TO JOB ANALYSIS

Assignment 4.1 - Definition Review

Directions: In order to insure participants have a clear understanding of the concepts covered in this lesson, please write an example for each of the terms given below.

Job:

Job Description:

Task Analysis:

Task:

UNIT FOUR: TASK ANALYSIS
LESSON 2 of 2: TYPES AND LEVELS OF BEHAVIOR

Content Summary

I. Presentation of Types and Levels of Behavior

A. Types of behavior.

1. Cognitive - Actions which involve knowing, understanding or applying information; remembering or using facts or ideas.

2. Affective - Expressions of feeling or interest; the adoption of an attitude or belief; the motivation to do something.

3. Psychomotor - Physical action, speed or agility; the performance of a particular body movement.

B. Levels of cognitive behavior.

1. Knowledge - Ability to state a fact, symbol, definition, procedure, etc.

2. Comprehension - Understanding the meaning of a piece of information; ability to explain or classify.

3. Application - Using knowledge and comprehension to complete some activity; use formula or rule, follow procedure.

4. Problem-solving - Determining what must be done to perform some task. Create a procedure; combine rules or formulas into new rule.

UNIT FOUR: TASK ANALYSIS
LESSON 2 of 2: TYPES AND LEVELS OF BEHAVIOR

Assignment 4.2 - Types and Levels of Behavior

Directions:

Under each knowledge statement, write the type of knowledge required. If the knowledge is cognitive, also write the level of behavior. (Note: Some statements involve all types. Identify the primary type of knowledge intended.)

1. The operator needs to be able to tighten a packing nut.

____

2. The operator needs to know the flow pattern through the plant.

____

3. The operator needs to know why the velocity through the grit chamber is one foot per second.

____

4. The operator needs to know that his job is important.

____

5. The operator needs to know when to increase the oxygen level in the trickling filter.

____

UNIT FIVE
OBJECTIVES SPECIFICATION - Unit Overview

Overview:

A crucial step in a systematic planning of instruction is the specification of the behaviors or competencies expected of those who receive the instruction. A trainer must be able to answer the questions "How will I know a participant has learned the material?" or, "What can I expect of one who has completed the instruction?" This unit will teach participants how to write learning objectives in behavioral terms.

Objectives:

LESSON 1: Participants will: (a) define the term "instructional objective," (b) describe why instructional objectives are important in the development of instruction, (c) identify examples of objectives stated in vague terms, and (d) list examples of objectives stated in explicit terms. The participants will attain at least a score of eight out of a possible ten points.

LESSON 2: Participants will write complete instructional objectives according to the three part format using guidelines given by the instructor.

LESSON 3: Participants will write instructional objectives of the same type and level as the task to be learned.

Resources:

LESSON 1: -Content Summary
-Assign. 5.1 - Introduction Review

LESSON 2: -Assign. 5.2 - Writing Instructional Objectives

LESSON 3: -Assign. 5.3 - Types and Levels of Objectives
-Six Objectives Score Sheet (Provided by the instructor)

UNIT FIVE: OBJECTIVES SPECIFICATION
LESSON 1 of 3: INTRODUCTION TO INSTRUCTIONAL OBJECTIVES

Content Summary

I. Definition of an Instructional Objective

Instructional objective: A statement that describes an intended outcome of instruction. It describes a proposed change in a learner and it gives a description of a specific behavior or performance.

II. Importance of Objectives

A. Objectives establish clear instructor and student goals.

B. Objectives enable selection of the most appropriate lesson content for on-the-job training programs.

C. Objectives permit selection of the most suitable instructional strategy.

III. Poorly Defined Objectives

A. Use vague or ambigous words.

B. Use verbs which are unmeasurable.

C. Suggest performance which cannot be observed.

D. Are unclear.

UNIT FIVE: OBJECTIVES SPECIFICATION
LESSON 1 of 3: INTRODUCTION TO INSTRUCTIONAL OBJECTIVES

Assignment 5.1 - Introduction Review

Directions:

Please answer the following questions based on material just completed.

1. Define the term "instructional objective."

2. List four reasons why instructional objectives are important in the development of instruction.

UNIT FIVE: OBJECTIVES SPECIFICATION
LESSON 2 of 3: WRITING INSTRUCTIONAL OBJECTIVES

Assignment 5.2 - Writing Instructional Objectives

Directions:

This is a self-instructional assignment. Please read the material and complete the exercises as directed.

WRITING INSTRUCTIONAL OBJECTIVES

Among the most useful educational planning devices are instructional objectives. They provide a blueprint for measuring the goals or desired outcomes of a learning experience. Instructional objectives are very useful to both the instructor and the learner for selecting or designing instruction, for directing the students' efforts to accomplish the intended objectives, and for evaluating the success of the instruction. The purpose of this module is to help you write clear instructional objectives. Read the brief description of the parts of an instructional objective given below. After reviewing this description you should be able to label segments of objectives as either "behavior", "condition" or "acceptable performance" without making any errors.

INSTRUCTIONAL OBJECTIVE COMPONENTS

Instructional objectives are measureable, observable goals for learning. They specify the intended outcomes of instruction in terms of the learner's behavior.

Effective instructional objectives contain the following three components:

1. Behavior - what students should do as a result of the learning experience.

2. Condition - constraints, requirements, limitations, or resources with which the behavior must be performed.

3. Acceptable Performance - required level, degree or quality of performance of the behavior.

Now try the exercise on the next page.

OBJECTIVE COMPONENT EXERCISE

Directions:

This exercise is designed to test your understanding of the three components of instructional objectives (behavior, condition, acceptable performance). Various pieces of objectives are given below. Identify each piece in terms of the component it represents by writing the component's name in the space provided.

Example: with the aid of the instruction manual. (condition)

1. with accuracy to four decimal places. __________
2. from memory. __________
3. with room temperature between 12 degrees C and 20 degrees C. __________
4. measure and place into the beaker ten moles of HCl. __________
5. calculate the chlorine dosage rate. __________
6. with no more than three errors. __________
7. using a calculator and F tables. __________
8. weigh and record the weight of the sample solution. __________

Check your work against the answers on the next page.

ANSWERS TO COMPONENT EXERCISE

1. acceptable performance.
2. condition.
3. condition.
4. behavior.
5. behavior.
6. acceptable performance.
7. condition.
8. behavior.

If all of your answers were correct, go on to the next page. If you missed any item, go over the material on the first page of this assignment and check to see that you understand why the answers given above are correct.

Please go on to the next page.

Directions:

The next three sections of this assignment describe in detail the three components of instructional objectives. Each section provides opportunities for practice in applying the various concepts which will also enable you to assess your progress.

I

BEHAVIOR

The description of the intended behavior is the most critical component of an instructional objective. It should clearly define the intent of the instruction in terms of a specific capability to be possessed by those who complete the instruction. It describes what someone WILL DO.

When learning is expressed in terms of observable behaviors, the instructor accepts the trainee's performance of that behavior as evidence that the objective has been achieved. Clear behavior statements effectively answer such questions as "How will I be able to judge when the trainees understand the material?" or, "What evidence will I accept as proof that they have learned what I taught?"

Defining the intent of the instruction in terms of explicit behaviors (capabilities, competencies, or performances) is also helpful to the trainee. Clearly stated objectives enable students to identify what is expected of them and when they have accomplished it.

Failure to describe the objective using observable behaviors can result in confusion over the true purpose of the instruction and evaluation of its achievement. For example, what does it mean "to know" how to operate a piece of equipment? Does "to know" mean to DESCRIBE how it operates, or to actually OPERATE it, or perhaps even to FIX it when it breaks? Simply describing an objective in such vague terms as "to know" or "to understand" does not clearly communicate the intent of the instruction. A clear and specific statement in the objective of what someone will be able to do leaves little doubt about the capabilities which the learner should possess.

Certain verbs are more useful for clearly defining observable behaviors than others. For example while "to understand" is vague, "to construct" leaves little doubt about the intended performance. Further examples are listed below.

Vague Terms Which Refer to Unobservable Behaviors:

- to know
- to really know
- to fully appreciate
- to grasp the meaning of
- to conceptualize fully
- to believe in
- to gain an understanding of
- to concentrate on
- to be mindful of
- to understand

Terms Which Refer to Clearly Observable Behaviors:

- to write
- to recite
- to draw
- to dictate
- to diagram
- to list
- to name
- to repair
- to separate into groups
- to compare and decide
- to identify (circle or underline)
- to measure and record
- to perform test
- to trouble-shoot
- to start up
- to analyze
- to adjust
- to divert
- to operate
- to consruct

Please go on to the next page.

EXERCISE ON BEHAVIOR COMPONENT

Directions:

Selected fragments of objectives are listed below. Each fragment contains a more or less observable description of the intended behavior. For each of the items, complete the following activities:

1. Underline the word or words which describe the intended behavior or outcome of the instruction.
2. Decide whether the underlined word or phrase describes a specific and observable, or vague and unobservable performance. Record your decision by checking the appropriate blank on the right.
3. For each statement you identify as vague and unobservable, create a more specific statement, and write it in the space directly below the original item.

	Specific	Vague
Example: The trainee will know the fire exits for each work area. (identify)	_____	(x)
1. Fully understand the inspection procedure.	_____	_____
2. Use the model to demonstrate the process of lubrication.	_____	_____
3. Name the chemistry tests required of this plant.	_____	_____
4. Develop a working use of submerged flow rate diagrams.	_____	_____
5. List four operating conditions which affect the primary sedimentation process.	_____	_____
6. Identify (label) the sections of a Parshall Flume.	_____	_____
7. Perceive the differences between the calibration procedures for two applicators.	_____	_____

8. Measure and record the concentration of flouride in a sample of drinking water. ____ ____

9. Diagram the parts of one applicator acceptable for pest control for outdoor nursery crops. ____ ____

Check your answers on the next page.

ANSWERS TO EXERCISE ON BEHAVIOR COMPONENT

	Behavior	Vague/Specific	New Behavior (Answers may vary)
1.	Understand	Vague	Describe in Writing
2.	Demonstrate	Specific	
3.	Name	Specific	
4.	Develop	Specific	
5.	List	Specific	
6.	Identify (label)	Specific	
7.	Perceive	Vague	List
8.	Measure and record	Specific	
9.	Diagram	Specific	

Were you able to correctly identify the behavioral terms in each of the examples? Did you have any difficulty in deciding whether they were specific or vague? For those that were vaguely stated, are you able to suggest a more specific statement? If you had any difficulties, review the preceding material and try to resolve the differences between our responses and the ones suggested above before continuing.

Please go on to the next page.

II

CONDITIONS

A second important component of instructional objectives is the description of the conditions under which the desired behavior is to be performed. That is, it is one thing to be able to describe the operation of a water treatment facility from memory, and quite another thing to describe its operation using a model of the facility. The difference between these two performances is in the CONDITION for the performance (from memory with no aids, as opposed to using a model). The precise nature of the intended condition can have a major impact on the interpretation of the intended behavior. For example, it is rather unclear what is expected of a student from the statement: Construct the Periodic Table of the Elements.

The task is more clearly expressed as: Given a list of chemical symbols and their atomic structure, construct a Periodic Table of the Elements.

But a rather different performance is suggested with a change in the stated condition: Without the use of books, notes, or other outside aids, construct the Periodic Table of the Elements.

As shown by these examples, a clear description of the condition of the behavior's performance answers such questions as: "With what materials or assistance will the behavior be performed?" or, "Under what circumstances will the performance be evaluated?" Note that describing the condition of PERFORMANCE is quite different from describing the condition of LEARNING. That is, neither of the example objectives included a statement like, "Given a unit of instruction on the Periodic Table..." Such a statement would have described the condition under which the behavior was learned rather than the circumstances surrounding its ultimate performance and would not have clarified the precise nature of the behavior itself. Confusing the condition for learning with the condition for performance is a common mistake that should be avoided in constructing good instructional objectives.

Try the exercise on condition statements on the next page.

FIRST EXERCISE ON CONDITION STATEMENTS

Directions:

Review the following list of possible condition statements. Circle those statements which might be used in an instructional objective to identify the condition for the intended behavior's performance.

1. name the hazards involved.
2. after studying Chapter Three.
3. with the use of a calculator.
4. without the use of the Instruction Manual.
5. raise the heated solution to eye level.
6. in less than 30 minutes.
7. graduate students in chemical engineering.
8. using the computational formula and table of common logarithms.

Please go on to the next page.

ANSWERS TO FIRST EXERCISE ON CONDITION STATEMENTS

You should have identified the following phrases as condition statements:

3. with the use of a calculator.
4. without the use of the Instructor Manual.
8. using the computational formula and table of common logarithms.

If you missed any of these or chose others, reread the previous material to determine why your response was incorrect. Ask your instructor for additional help if necessary.

Please go on to the next page.

SECOND EXERCISE ON CONDITION STATEMENTS

Directions: Write a clear description of the condition under which the behavior is to be performed for each of the following incomplete instructional objectives.

Example: First year biology students will label with 100 percent accuracy the four chambers of the heart, the aorta and the pulmonary artery.

Condition: (given a model of a heart)

1. Wastewater Lift Station Maintenance Mechanic II's will diagnose malfunctions in pumping station equipment. Their diagnoses must be correct as determined by their supervisors.

   Condition: ____________________

2. Sewage Treatment Technology students will describe what happens during each of the major stages of biological treatment.

   Condition: ____________________

3. Students enrolled in the course "Water Supply Studies" will state the maximum acceptable nitrate content allowed in drinking water according to the Safe Water Drinking Act.

4. Weed Control Farm Advisors will be able to calculate the standard deviation of field sample particulate densities.

   Condition: ____________________

Check your work against the suggested responses on the next page.

SUGGESTED RESPONSES TO SECOND EXERCISE ON CONDITION STATEMENTS

1. Given a faulty piece of equipment, its service manual, and the lift station tool set.
2. Given a list of the stages of biological treatment.
3. Without the use of books, charts, notes, or other aids.
4. Given the density measures of the samples collected.

Your answers may be different from the ones suggested here. To be considered correct, your answers must:

1. Specify the condition under which the performance is to be evaluated; and
2. not describe the condition under which the behavior was learned.

Note: It is not necessary to list trivial conditions such as "Given a pencil, blank paper, a desk, chair, etc."

A smooth moving objective often requires the condition to be stated first, followed by the behavior component (i.e. Given the __________, the student will...).

If any of your condition statements seem vague or general by comparison, clarify them before going on.

Please go on to the next page.

IV

ACCEPTABLE PERFORMANCE

The acceptable performance of an effective instructional objective is the degree to which the intended audience performs the desired behavior. It is the standard of performance which allows both the instructor and the student to determine when the objective has been successfully completed.

The degree of acceptable performance will differ according to the type and importance of the objective of which it is part. Students learning the names of the 50 states may not be required to list every state from memory. However, a surgeon is expected to perform every step of an operation without error.

Try the exercise on acceptable performance statements on the next page.

ACCEPTABLE PERFORMANCE EXERCISE

Directions:

Write a clear description of the degree of acceptable performance required for each of the incomplete objectives below.

1. Given appropriate record sheets, Operator I's will read and record all meter levels associated with a specific piece of equipment.

Acceptable Performance: ________________________________

2. Given a faulty water meter, the maintenance staff member will diagnose the problem and repair the meter.

Acceptable Performance: ________________________________

3. Given a blank discharge monitoring report form, the operations log book, and the laboratory record book, the plant superintendent will calculate and record the required data on the form.

Acceptable Performance: ________________________________

4. Given a copy of the plant layout, Operator Trainees will identify (by circling) the location of pressure gauges to be checked during rounds.

Acceptable Performance: ________________________________

5. Given a description of a major equipment malfunction, a shift foreman will list the emergency procedures to be followed:

Acceptable Performance: ________________________________

Now check your answers on the next page.

SUGGESTED ANSWERS TO ACCEPTABLE PERFORMANCE EXERCISE

1. All readings will be recorded at the proper place on the form and will be correct plus or minus 2 percent.

2. The repaired meter will be in 100 percent working order.

3. The form will be completed within sixty minutes and will contain no errors.

4. Without error.

5. All procedures will be included and will be listed in sequential order.

Your answers may be different from the ones suggested here. To be considered correct, your answers must specify the degree or standard of performance which is to be an acceptable evidence that the instructional objective is successfully completed.

If any of your performance statements seem vague or general in comparison to the suggested answers, clarify them.

Please go on to the next page.

SUMMARY

Instructional objectives represent the instructor's goals or desired outcomes for the learning experience. Effective instructional objectives can be very useful to the instructor for the selection and designing of instruction, learning materials and tests; for evaluating the success of instruction; and for directing the student's efforts. Students find instructional objectives useful to direct their learning and to know exactly what performance is required. It is very important, if the instructor's desired outcomes are to be realized, (1) the performance which demonstrates the desired outcome be specified in terms of observable behavior, (2) the intended performance condition be clearly communicated, and (3) the degree of acceptable performance be specified.

All components of the instructional objective need not always be written when the instructor is certain there is no misunderstanding. These components should be viewed only as guides or aids for the instructor in the management of the learning process. Clear, effective instructional objectives offer students not only enhanced learning but also positive experiences since unclear directions and misunderstandings are minimized.

UNIT FIVE: OBJECTIVES SPECIFICATION
LESSON 3 OF 3: LEVELS OF OBJECTIVES

Assignment 5.3 - Types and Levels of Objectives

Directions:

This is a self-instructional assignment. Please read the material and complete the exercises as directed.

TYPES AND LEVELS OF OBJECTIVES

In Unit Four, the concepts of type of behavior and level of cognitive behavior were introduced. It was explained that the performance of various steps of a task may require very different types of behavior (cognitive, affective, or psychomotor), or represent a particular level of cognitive behavior (knowledge, comprehension, application, or problem solving). The particular type and level of behavior called for in a step's performance must be considered in designing effective training on that step. Good instructional objectives are written to clearly indicate the type and level of behavior being taught.

This assignment reviews the key concepts and provides practice in constructing objectives for different types and levels of cognitive behaviors. (An emphasis is placed on cognitive objectives since they are the most common and important learning outcomes for training programs designed to address skill or knowledge problems.)

TYPES OF BEHAVIOR AND INSTRUCTIONAL OBJECTIVES

COGNITIVE BEHAVIORS involve knowing, understanding, or applying information or procedures. This workshop is almost totally concerned with providing training in the cognitive behaviors required to plan and conduct instruction. Excerpts from some of the workshop's objectives addressing cognitive behaviors are listed below.

"...participants will list the phases of a systematic approach to instruction and explain each briefly..."

"...participants will plan and construct simple written tests..."

"...participants will identify appropriate uses of audio tapes..."

AFFECTIVE BEHAVIORS involve feelings and attitudes toward something. They include expressions of interest, the adoption of an attitude or belief, or the motivation to do something. Affective behaviors can have an important influence on how a particular job or task is performed. Excerpts from several of this workshop's objectives which address affective behaviors follow.

"...participants will express increased interest in learning procedures for planning effective instruction..."

"...participants will feel more at ease speaking in front of a group..."

PSYCHOMOTOR BEHAVIORS involve physical action, the performances of a particular body movement. Psychomotor behaviors become the focus of training activities when a particular task requires physical agility, speed, precision, or coordination. (While cognitive or affective behaviors may also be involved, the primary behavior of interest is a physical action.)

While psychomotor behaviors are generally not the focus of this workshop, the unit on oral presentation skills does contain a few objectives addressing very specific kinds of psychomotor behaviors.

"...speakers will maintain eye contact with audience..."

"...speakers will vary volume level and tone of voice..."

"...speakers will not exhibit distracting mannerisms..."

Many activities involve all three types of behavior to some degree. Even a simple task like "check the filter" requires that the employee know what is to be done (cognitive), chooses to do it (affective), and physically inspects the filter (psychomotor). However, in most training situations it is readily apparent that one type of behavior is the major concern. In this example the primary emphasis would be on the cognitive behavior of knowing to check the filter (probably as one step in a larger maintenance task).

For most of the training programs you will be concerned with, the instructional objectives will typically address cognitive behaviors. Sometimes they may involve affective behaviors. Only rarely will a psychomotor behavior be the target of instruction. (Most required psychomotor behaviors are simply assumed to be a basic entering competency for anyone holding a job.)

Please go on to the next page.

EXERCISE ON IDENTIFYING INSTRUCTIONAL OBJECTIVES BY TYPE OF BEHAVIOR

Directions:

Read the following objectives and decide whether the concern is with cognitive, affective, or psychomotor learning. Indicate your decision by labeling each objective by type of behavior in the blank on the right.

1. Given dough and a doughnut cutter, the baker will cut 50 doughnuts in 10 minutes.

   Type of behavior? ______________________________

2. Given a completed Task Detailing Sheet, the participant will write instructional objectives using all three objective components.

   Type of behavior? ______________________________

3. At the plant site, plant mechanic trainees will maintain a higher level of interest in the training program as demonstrated by a 75 percent decrease in absenteeism.

   Type of behavior? ______________________________

4. Given a calculator and the dimensions of the storage tank, the operator will calculate the volume of the tank to the nearest gallon.

   Type of behavior? ______________________________

Check your answers on the next page.

ANSWERS TO EXERCISE ON IDENTIFYING INSTRUCTIONAL OBJECTIVES BY TYPE OF BEHAVIOR

1. Psychomotor behavior.
2. Cognitive behavior.
3. Affective behavior.
4. Cognitive behavior.

If you failed to properly identify any of the four objectives, reread the preceding material and reconsider your answer(s). Talk to your instructor if you have any particular questions.

Please go on to the next page.

LEVELS OF COGNITIVE OBJECTIVES

As explained in Unit Four, there are four levels of cognitive behavior as follows:

1. Knowledge - the ability to state a fact, describe a symbol or repeat a definition.

2. Comprehension - the ability to explain or classify procedures or information.

3. Application - the ability to apply an existing knowledge or comprehension of something to conduct some procedure or derive information.

4. Problem-Solving - the ability to invent new information or procedures based on past experience.

The four levels are listed in order from the simplest to the most complex forms of cognitive behaviors. Each advanced level assumes the possession of preceding levels of behavior. Thus, problem-solving activities require that the relevant facts or procedures are known (level 1), understood (level 2), and can be properly applied (level 3) to the new situation.

When "cognitive behavior" is the focus of instruction, it is important that the objective specify the precise level of behavior desired. The design of the training activity will vary greatly depending on the level of cognitive performance required. For example, it is one thing to teach someone to name the parts of a piece of equipment (level 1), and quite another to prepare to "trouble-shoot" problems in the operation of that equipment (level 4).

One way to insure that an instructional objective specifies the desired level of cognitive performance is to carefully consider the verb used to describe the behavior. Different verbs naturally refer to different levels of cognitive performance. The list on the next page provides some example verbs for describing each level. Read the list carefully and notice how the level of behavior suggested by the verbs changes from column to column.

USEFUL VERBS FOR EXPRESSING COGNITIVE BEHAVIORS IN WRITING INSTRUCTION OBJECTIVES

KNOWLEDGE

- draw
- duplicate
- find
- gather data
- identify
- label
- list
- match
- repeat
- recognize
- state
- define

COMPREHENSION

- classify
- categorize
- cite evidence for
- contrast
- illustrate
- describe
- differentiate
- discriminate
- distinguish between
- explain
- give examples

APPLICATION

- analyze
- calculate
- compute
- conduct
- construct
- estimate
- install
- interpret
- manipulate apparatus
- measure
- organize data
- plot graph
- prepare
- produce
- prove
- reformulate
- relate
- specify limitations and assumptions

PROBLEM-SOLVING

- create
- develop
- devise method
- discuss
- evaluate
- formulate hypotheses
- generalize from data
- infer
- integrate
- invent a new solution
- manipulate ideas
- plan
- predict
- propose reasons and defend them
- reorganize
- solve a problem
- synthesize

Note: These cannot be offered as concrete verb use rules. They are only suggestions; no more than typical.

EXERCISE ON IDENTIFYING LEVELS OF COGNITIVE BEHAVIORS

Directions:

Read the following objectives and, for each, decide whether the specified cognitive behavior is at the knowledge, comprehension, application, or problem-solving level. Indicate your decision by labeling each objective by level of cognitive behavior in the blank on the right. (You may want to refer to the verb list on the preceding page if you have any difficulty deciding on the level.)

1. Participants will identify 10 important variables in the physical and interpersonal environment of the classroom from memory.

   Level of cognitive behavior? ______________________________

2. Given acetate sheets and marking pens, participants will develop two overhead transparencies using all of the principles for designing good instructional graphics.

   Level of cognitive behavior? ______________________________

3. Working with the task analysis and objectives developed as parts of previous units, participants will plan an evaluation to conform to concepts in Unit Six.

   Level of cognitive behavior? ______________________________

4. From memory, participants will define the concepts of "job," "task," and "task analysis" with 80 percent accuracy.

   Level of cognitive behavior? ______________________________

Check your answers against those on the next page.

ANSWERS TO EXERCISE ON IDENTIFYING LEVELS OF COGNITIVE BEHAVIORS

1. Knowledge.
2. Problem-solving.
3. Problem-solving.
4. Knowledge.

If your answers do not agree with these, reread the previous section and check to see that you understand the concepts involved. You may wish to discuss this material with your instructor.

Please go on to the next page.

EXERCISE ON WRITING INSTRUCTIONAL OBJECTIVES FOR DIFFERENT LEVELS OF COGNITIVE BEHAVIOR

Directions:

Using specific tasks from your own job, write two complete instructional objectives for each level of cognitive behavior. (It may be useful to refer to the list of verbs again.)

You will discuss your responses in a small group. Your instructional objectives will be evaluated on the extent to which they contain clear descriptions of the behavior, conditions, and degree. Use additional paper if necessary.

Knowledge Level Objectives:

1.

2.

Comprehension Level Objectives:

3.

4.

Application Level Objectives:

5.

6.

Problem-solving Level Objectives:

7.

8.

OPTIONAL EXERCISE

Directions:

If there is time remaining, you may wish to try writing affective and psychomotor objectives on some subject or area familiar to you. These objectives should contain the same three components of any good instructional objective. Hand your objectives in to the instructor for review.

BASIC INSTRUCTIONAL TECHNOLOGY

UNIT SIX
EVALUATION TECHNIQUES - Unit Overview

Overview:

Evaluation is an important component of many training related activities. Evaluation activities can be used by the instructor to motivate students, reinforce desired learning outcomes, and gather feedback on the progress and success of training programs. The techniques of evaluation are also essential tools for the assessment of employee job performance and training needs. This unit provides a basic introduction to the concepts and tools of evaluation.

Objective:

LESSON 1: Working with the information gained from the task analysis and instructional objective completed in Units Four and Five, participants will define evaluation, plan the use of evaluation activities (written tests, check lists, rating scales) and offer explanations of their decisions.

Resources:

LESSON 1: -Content Summary
-Assign. 6.1 - Evaluation Practice

UNIT SIX: EVALUATION TECHNIQUES
LESSON 1 of 1: THE NATURE OF EVALUATION

Content Summary

I. Definition of Evaluation

Definition: "Evaluation" can be defined in many different ways. Two useful definitions describe what it is and what it does.

A. Evaluation IS:

1. Evaluation can be defined as a systematic process for collecting, analyzing, and preparing information to provide a careful description of the subject of concern. This descriptive information can then be used to reach judgments regarding the present or future worth of that subject.

2. This definition of evaluation indicates that evaluation involves both description and judgment.

    a. Description provides information - a portrayal of the quality, characteristics or nature of some activity, program, etc.

    b. Judgment involves deciding upon the worth of one thing or activity relative to the worth of something else. It involves comparison.

        1. Comparison of one thing against similar things. (Example: comparing the performance of three new cars to decide which to buy.)

        2. Comparison of one thing against an absolute standard. (Example: judging cattle at the state fair on the extent to which each possesses certain ideal characteristics of weight, color, size, markings, etc.)

        3. Comparison of one thing against itself at a different point in time. (Example: a farmer's judgment of the quality of his crops before and after the application of a pesticide.)

B. Evaluation DOES:

1. Evaluation can also be defined by what it does - the specific functions it fulfills. For training programs, evaluation may serve four functions.

   a. Determine existing capabilities of employees as a basis for identifying necessary training programs.

   b. Provide feedback to trainees during an instructional activity to let them know how they are progressing.

   c. Provide opportunities for trainees to practice using a new skill.

   d. Determine (or certify) the preparation of a trainee to do a particular job.

II. Written Tests, Rating Scales and Check Lists

A. Specific techniques.

Of the many different kinds of evaluation techniques, only a few of the most relevant ones for training purposes will be considered. Specifically:

1. Written tests - based on multiple choice, short answer, and essay items.

2. Checklists and rating scales.

B. Nature and uses of written tests.

1. Nature.

   a. Written tests - the familiar "classroom" test.

   b. May be based on any of the following formats:

      1. Essays.

      2. Short answer (or "fill-in-the-blanks").

      3. Multiple choice.

      4. True/false.

2. Uses

   a. Written tests are perhaps the most common form of instructional evaluation.

      1. They are a useful means of evaluating cognitive skills such as:

         a. Knowledge.

         b. Comprehension.

         c. Application.

         d. Problem Solving.

      2. Written tests are also useful for providing:

         a. Quick feedback to the instructor or trainee.

         b. A precise, fairly impartial record of trainee performance.

   b. Written tests are frequently one of the easiest ways to evaluate training outcomes in the classroom, but they are usually not as good as direct evaluations of the trainees' actual on-the-job performance. However, if the required job performance can be duplicated in a written test, then a written test is all that is needed.

C. Nature and use of rating scales and checklists.

1. Nature

   a. Checklist: a list of skills or tasks which the trainee is expected to demonstrate in the satisfactory performance of a job. This is a very useful technique for evaluating a complex job when there is a specific series of steps to be completed.

   b. Rating Scale: a list of skills or tasks with each so carefully defined as to permit the evaluator to judge the relative quality of the performance. This technique is useful when there is a concern for grading or ranking the relative quality of a performance.

2. Use.

Checklists and rating scales are techniques for evaluating trainee (or employee) performance of a particular task, skill or procedure. They are particularly useful for evaluation of on-the-job performance. They enable the instructor and the trainee to see whether the "classroom learning" is correctly transferred to the real setting. They also enable the instructor to provide corrective feedback on task performance and/or certify trainee competence on a task.

UNIT SIX: EVALUATION TECHNIQUES
LESSON 1 of 1: THE NATURE OF EVALUATION

Assignment 6.1 - Evaluation Practice

Directions:

Using the objectives written during Unit Five, Lesson 3, you should first define the term evaluation then determine the method of evaluation you would use to determine whether or not a student had successfully learned the objective. Justify your choice.

1. Define evaluation.

2. Determine the method of evaluation for at least three objectives.

   a. Evaluation form:

      Justification:

   b. Evaluation form:

      Justification:

   c. Evaluation form:

      Justification:

UNIT SEVEN
INSTRUCTIONAL METHODS - Unit Overview

Overview:

Effective instruction requires more than specifying objectives and listing content topics. Instructors must also select appropriate methods to deliver the content and make the most efficient use of available media. This unit introduces the basic knowledge and skills needed to design effective instruction.

Objective:

LESSON 1: Participants, during a question and answer period, will describe the activities by which appropriate instructional methods and sequences of methods are selected.

LESSON 2: Participants will describe four types of instructional methods and list the advantages and disadvantages of employing each method.

LESSON 3: Participants will describe from memory the Instructional Methods Selection Table, describe the table in terms of the categories presented and in which ways these categories have different applicability to each type and level of behavior, and explain how the information obtained from this table can directly inform decisions on the Instructional Approach Section of the IPW.

LESSON 4: Given a specific objective with type and level of behavior identified, participants will identify appropriate instructional methods using the Instructional Methods Selection Table provided.

Resources:

LESSON 1: -Content Summary

LESSON 2: -Content Summary

LESSON 3: -Content Summary
-Instructional Methods Selection Table

LESSON 4: -Assign. 7.1 - Selecting Instructional Methods

UNIT SEVEN: INSTRUCTIONAL METHODS
LESSON 1 of 4: INTRODUCTION

Content Summary

I. Instructional Decisions and the Systematic Approach

   A. The systematic process.

      1. Phase one: Analysis

         a. Define the problem (Unit Three).

         b. Analyze the tasks (Unit Four).

      2. Phase two: Design

         a. Specify instructional objectives (Unit Five).

         b. Determine evaluation activities (Unit Six).

      3. Phase three: Development

         a. Select instructional methods (Unit Seven).

II. The Development Phase

   A. The nature of development.

      1. Selection of means and ways of facilitating learning.

      2. Learning activities and instructional activities.

         a. Learning activity: something a learner does to help learn. (e.g.. watches a demonstration, reads a manual)

         b. Instructional activity: something an instructor does to help trainees learn. (e.g.. gives a lecture, assigns problems to be solved)

      3. Instructional methods are ways of providing instructional activities and learning activities.

B. Components of the development phase.

   1. Identify and classify available resources.

   2. Select instructional methods that are consistent with the types of available resources and with the type and level of desired behavior.

C. Result of the development phase.

   1. A set of instructional methods which lead trainees toward mastery of objectives.

   2. A list of resources that are available for use during instruction.

UNIT SEVEN: INSTRUCTIONAL METHODS
LESSON 2 of 4: FOUR TYPES OF INSTRUCTIONAL METHODS

Content Outline

I. Four Types of Instructional Methods

A. Four types of methods.

The four methods represent four possible types of communication between instructors and learners.

1. Lecture - communication of verbal information from instructor to learners.

2. Demonstration - communication of verbal information and visual display of skills from instructor to learner, including practice.

3. Guided Discussion - sharing of communication among instructor and learners.

4. Individualized Instruction - individual reception of communication from printed materials or from a tutor.

B. The lecture (method #1).

1. Definition: Uninterrupted speech by which one presents information to others.

2. Characteristics of a good lecture.

   a. The lecturer has good oral presentation skills.

   b. The presentation is:

      1. Brief - usually no more than 15-20 minutes of uninterrupted speech; a lecture should not strain normal attention span.

      2. Organized - a chart of organization follows:

         -Introduction - establishes rapport between lecturer and learners; defines the purpose of the lecture, gains learners' attention, and motivates them to remain attentive; outlines the major points of the lecture; and defines the objectives of the lecture.

         -The Body - uses a simple-to-complex structure for presenting the content, aims toward specific objectives, provides opportunities for questioning, and allows for practice of knowledge.

         -The Conclusion - reviews and summarizes main points, opens opportunity for student responses, and provides directions to the next activity.

      3. Accompanied by media (when appropriate). Media includes:

         -Highlighting - visual accompaniments such as outlines, graphics, pictures; reinforce content during the lecture.

         -Student Handouts - "take-homes" such as outlines, procedural guidelines, etc.; serve as a personal employee manual for on-the-job use.

3. Advantages.

   a. Presents large amounts of information from many or from hard-to-get sources in short amount of time.

   b. Gives instructor conrol over the kind of information and organization presented.

   c. Provides the most efficient way to introduce and to summarize a learning experience.

4. Disadvantages.

   a. Over-stresses acquisition of facts.

   b. Can make learners into passive, dependent receivers of information.

   c. Is instructor-paced.

   d. Often exceeds the learners' attention or interest span.

   e. Is often over-used or misused.

   f. Depends for success on instructor's oral presentation ability.

C. Demonstration (method #2).

1. Definition: Showing, as opposed to telling, how to do something by manipulating appropriate materials and equipment.

2. Characteristics of a good demonstration.

   a. The instructor prepares the site and materials.

      1. On-location or simulated site is chosen and prepared for maximum effectiveness and visibility to all learners.

      2. Materials and equipment obtained and tested by working through demonstration.

      3. Setup should allow everyone to see demonstration.

      4. Media/handouts prepared to complement demonstration. (i.e.. steps outlined, decision points and criteria defined, "success" described in terms of predefined criteria.)

   b. The instructor prepares for the students.

      1. Necessary orientation information developed.

      2. Mini-lectures for introducing and summarizing the procedure prepared.

      3. Frequent opportunities provided to ask questions.

      4. Frequent checks to insure student understanding.

      5. Opportunities to practice the procedure.

   c. The instructor follows up.

      1. Reviews and evaluates student practice sessions.

      2. Reviews the procedure in other teaching situations.

3. Advantages.

    a. Gives hands-on experience.

    b. Allows learners to develop and practice skills under supervision.

4. Disadvantages.

    a. Not useful alone; must be prepared for and summarized through lecture or reading.

    b. Large groups of learners require much time for practice in order to be effective.

    c. Useful only for fixed-step procedures, not for creative problem solving.

    d. Requires equipment, materials, and often, site visits.

    e. Sometimes limited to a smaller group of learners so all can see the process and procedure.

    f. Some danger (fumes, explosions, burns, mechanical injuries, etc.)

D. Guided discussion (method #3).

1. Definition: A structured sharing of ideas and opinions in order to arrive at a mutually acceptable decision or solution to a problem.

2. Characteristics of a good discussion.

    a. Not a bull session - topics and objectives must be carefully prepared and purpose explicitly defined so group will know when discussion should end.

    b. Groups should be small enough to allow everyone to participate and large enough to avoid polarization or domination by a few.

    c. Discussion leader:

        1. Initiates discussion by stating topics, objectives, and guidelines (rules for participating, parameters of discussion).

        2. Coordinates discussion by summarizing ideas and establishing relationships among ideas.

        3. Orients discussion by pulling discussion back to topic; avoids playing expert and giving lectures.

        4. Encourages participation by warmth, non-critical analysis of contributions, and questioning silent members in non-threatening way.

        5. Harmonizes the group by dealing with personal confrontations and disagreements and arbitrating as necessary.

        6. Monitors by preventing anyone from dominating the group.

    d. Physical environment is arranged to facilitate discussion by insuring eye contact among all participants.

3. Advantages.

    a. Allows all members of group opportunity to share ideas.

    b. Provides for mutual solving of a problem and practice in ways of solving problems.

4. Disadvantages.

   a. Can be dominated by an individual or faction.

   b. Can degenerate into an exchange of abuse.

   c. Can bog down in extended, uncomfortable silence or irrelevancies.

   d. Can degenerate into leader-provided lectures.

   e. Can be misused (not suitable for communicating factual information or teaching procedures).

E. Individualized instruction (method #4).

1. Definition: Instruction adapted to individual needs, goals, learning materials and/or instructional methods, and techniques chosen specifically to suit a particular student or group of students.

   Types of individualized instruction: Individualized learning packages, assignments, computer assisted instruction (CAI) and tutoring.

2. Characteristics of good individualized instruction.

   a. Characteristics of effective individualized learning packages include:

      1. Provides all the information and materials learner needs to know on learner's own.

      2. Provides for practice and feedback.

      3. Is structured properly (orienting overview, body with logical learning steps, summarizing review).

      4. Meets individual needs of learners in terms of pacing, level of sophistication and learning style.

   b. Characteristics of effective assignments include:

      1. Application oriented - allows students to apply knowledge and skills in new or unfamiliar contexts.

      2. Allows for choice - provides options so the students can choose among alternative assignments, contexts, or subjects.

      3. Builds skills in specific steps from simplest to most complex.

   c. Characteristics of effective computer assisted instruction (CAI) include:

      1. Simple mechanical manipulation that does not interfere with the learning process.

      2. Fulfills characteristics of non-computer individualized learning packages or tutoring, depending on what the objective of the CAI is.

d. Characteristics of effective tutoring include:

1. A one-to-one session between tutor and learner (tutor need not be the instructor; could be a peer).

2. Problem-solving orientation using stages of diagnosis and remedy.

3. Skills built in specific steps.

4. Tutor guides learner to discover answers - does not lecture at learner.

5. Session is problem-specific and ends when solution is discovered.

3. Advantages.

a. Responsive to individual needs.

b. Allows for learner pacing and repetition as desired.

c. Individualized learning packages can be given out when it is difficult to organize a class or too few students or no instructor is available.

d. Tutors can be used to help several learners with difficult problems in a short space of time.

e. Computer assisted instruction can be utilized in any situation where the machine is available (whether designed for CAI, used during business hours for other computer functions or privately owned).

4. Disadvantages.

a. Instructor-made individualized learning packages are expensive to prepare.

b. May not be suitable for complex or complicated subject matter.

c. Not useful for teaching procedures that require equipment or complicated materials.

d. Does not allow for exchange of ideas and opinions - basically a lonely method of learning.

UNIT SEVEN: INSTRUCTION METHODS
LESSON 3 of 4: SELECTING INSTRUCTIONAL METHODS

Content Outline

I. Selecting Instructional Methods

   A. In order to select a method or sequence of methods, the instructor must:

      1. Identify the type and level of behavior specified in the objective.

      2. Use the level and type of behavior to select a method from the Instructional Methods Selection Table.

   B. Considerations in selecting methods.

      1. Most instruction consists of a sequence of methods, each of which may have a relatively short duration. The sequence, which is designed to teach a single objective, constitutes a single lesson.

      2. Trainees need opportunities to practice what they are learning. Application assignments, therefore, must form a large and significant part of successful instruction. Thus, most method sequences include frequent practice assignments and exercises, either in class or take-home.

      3. When more than one instructional method appears appropriate for a given instructional situation, the most efficient method in terms of preparation time, number of resources needed, and class size should be chosen.

INSTRUCTIONAL METHODS SELECTION TABLE

Types of Behavior	Instructional Method Lecture	Demonstration	Guided Discussion	Individual Instruction
Cognitive: Knowledge	A	P	P	A
Cognitive: Comprehension	A	A	P	A
Cognitive: Application	A	M	P	A
Cognitive: Problem Solving	P	A	A	A
Psychomotor	A Demon.	M	P	A Demon.
Affective	P	A	A	P

Legend: A = Appropriate and useful
M = Most appropriate
P = Not generally useful

UNIT SEVEN: INSTRUCTIONAL METHODS
LESSON 4 of 4: EXERCISE IN SELECTING METHODS

Assignment 7.1 - Selecting Instructional Methods

Directions:

This assignment is designed to give you practice in selecting instructional methods and planning a lesson. You will use the Instructional Methods Selection Table and the Instructional Package Worksheet to design a lesson on a step of wastewater lagoon operation. A Problem Scenario and completed Task Detailing Sheet are included as resources. Your task is to select, from the Task Detailing Sheet, one step that needs to be taught (see column D on the Task Detailing Sheet), and to complete an Instructional Package Worksheet for a lesson on that step. You will specify the instructional objective, entering competencies, and evaluation activity, and use the table provided to choose the most appropriate method for use in instruction. You will have approximately 45 minutes in which to work. The remaining 15 minutes will be spent in a discussion of any problems or concerns involved in using the Selection Table and completing the Instructional Package Worksheet (IPW).

1. Complete the Exercise described on the following pages. Use the Task Detailing Sheet and IPW provided. This task should take approximately 45 minutes.

2. Discuss the completed forms with fellow participants. This task should take approximately 15 minutes.

EXERCISE DESCRIPTION

You have been asked to analyze a problem about an annoying odor in town from the lagoon. The nature of the problem is explained in the Problem Scenario, which is attached. After analyzing the problem and finding it to be amenable to a training solution, you have completed the Task Detailing Sheet, which is also included here. Your task now is to plan a lesson on one of the steps of lagoon operation. Use the IPW and the Instructional Methods Selection Table to plan instruction on one step of the task listed on the Task Detailing Sheet. Record your decisions on the IPW. Be prepared to explain and justify all decisions during a discussion which completes the assignment.

PROBLEM SCENARIO

In the past two weeks, the mayor's office has received numerous complaints about the anaerobic odors from the lagoon drifting into town. With elections only a month away, the mayor is understandably concerned and has asked you to investigate the problem and solve it.

You learn that:

1. The lagoon is operating at capacity.
2. A new operator with no operational experience was hired two months ago.
3. DO levels in the lagoon are lower than they were the same time last year.

After an inspection of the lagoon and an interview with the operator, it is evident that the maintenance of the lagoon is at fault. You complete the Task Detailing Sheet (shown completed on the following page). Now you will complete an IPW on one of the steps identified as a training need.

TASK DETAILING SHEET

A. Write Job Title (Lagoon Operator)

B. Write Task (Lagoon Maintenance)

Complete steps C-F in the space below.

C. List the specific steps required to perform the task.

D. Check each step which needs to be taught.

E. Indicate whether the checked steps primarily involve cognitive, affective, or psychomotor behavior.

F. For a cognitive behavior, indicate the appropriate level of performance:

Knowledge - ability to recall information or procedures.

Comprehension - ability to explain information or procedures.

Application - ability to use information or procedures to do something.

Problem-Solving - ability to develop new information or procedures.

Steps Required to Perform Task	Needs to be Taught	Type of Behavior Cognitive, Affective, Psychomotor	Level of Cognitive Behavior: Know., Comp. Appl., P.S.
1. (Check and Control Weeds)	(checked)	(Cognitive)	(Application)
2. (Keep fences in repair)		(Psychomotor)	
3. (Keep access road passable)		(Cognitive)	(Knowledge)
4. (Maintain security)		(Cognitive)	(Application)
5. (Maintain berm)		(Cognitive)	(Application)

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM:

COURSE:

UNIT:

LESSON:

Estimated time:

Entering competencies:

Justification:

Objective:

Evaluation Activities:

Resources:

Instructional Approach:

UNIT EIGHT
INSTRUCTIONAL MEDIA AND RELATED RESOURCES - Unit Overview

Overview:

Media has become an integral part of modern instruction. Through EPA's Instructional Resources Information System (IRIS), a variety of visual materials are available relevant to environmental quality control subjects. This unit is designed to provide the basic information and skills needed to select and employ media in support of effective instruction. Among the topics to be covered are the reasons for using media, a description of the various types of instructional aids available, an exercise in choosing media, a description of some of the sources to gain media, and the principles of appropriate media use.

Objective:

LESSON 1: Given Assignment 8.1, participants will recall the two rules of using media, describe the importance of the split hemisphere theory in teaching and recall the retention level effectiveness under various conditions.

LESSON 2: Participants will list appropriate media for use in teaching three objectives.

LESSON 3: Participants will select the media most appropriate for accomplishing a given objective using the Media Selection Table from this lesson. The chosen media must agree with the principles set forth in this lesson.

LESSON 4: Participants will describe the services for locating media offered by the Instructional Resources Information System (IRIS), EPA's Instructional Resources Center (IRC), the National Environmental Training Association (NETA), and local sources.

LESSON 5: Participants will recall on an assignment the three major steps involved in the use of media and describe the process of visualization.

Resources:

LESSON 1: -Content Summary
-Assign. 8.1 - Exercise

LESSON 2: -Content Summary
-Assign. 8.2 - Media Choices

LESSON 3: -Media Selection Table
-Assign. 8.3 - Exercises

LESSON 4: -Content Outline
-Sample IRIS Abstracts

LESSON 5: -Content Outline
-Programmed Notes

UNIT EIGHT: INSTRUCTIONAL MEDIA AND RELATED RESOURCES
LESSON 1 of 5: REASONS FOR THE USE OF TRAINING AIDS

Content Outline

I. Introduction

  A. Media use for focusing on objective.

  Rule One: The media should always focus on one or more objectives.

  B. Review domains of learning.

    1. Cognitive.

    2. Affective.

    3. Psychomotor.

  C. Using the information to reinforce learning.

  Rule Two: Always have the student do something with the information from the media after the media has been presented.

II. Effects of Media

  A. Retention.

    1. 10 percent - reading.

    2. 20 percent - hearing.

    3. 30 percent - seeing.

    4. 50 percent - seeing and hearing.

    5. 70 percent - saying.

    6. 90 percent - seeing and doing.

  B. Split hemisphere learning.

    1. Sides of brain control opposite sides of body.

    2. Sides of brain record different types of information.

      a. Left side - linear functions, logic, time, reasoning, language, writing.

    b. Right side - space, movement, emotion, facial recognition, music, depth perception.

3. It is the combination of the effects of both sides that allows us to think and react to information.

4. Retention of information is improved from visualizing what is said because the information is stored in both sides of the brain making retrieval much better.

UNIT EIGHT: INSTRUCTIONAL MEDIA AND RELATED RESOURCES
LESSON 1 of 5: REASONS FOR THE USE OF TRAINING AIDS

Assignment 8.1 - Exercise

Directions:

Answer the questions. The exercise will be corrected in a guided discussion to follow.

1. The first rule of media use is always ______________ on one or mo of the ______________.

2. The second rule of media use is always have the student ______________ with the information from the media after the media has been presented.

3. As far as retention of knowledge is concerned, learning by __________ is the least effective while learning by ______________ is the most effective.

4. Spoken and written words are generally recorded in the ______________ side of the brain.

5. Visual images are generally recorded in the ______________ side of the brain.

6. What is the importance of the split hemisphere brain theory to learning?

UNIT EIGHT: INSTRUCTIONAL MEDIA AND RELATED RESOURCES
LESSON 2 of 5: INTRODUCTION TO TYPES OF TRAINING AIDS

Content Outline

I. Definition of Medium

Definition: Medium of instruction - a channel of communication through which instruction is presented to the learner.

II. Discussion of Categories of Media

A. Categories of media.

1. Tangible aids.

2. Still pictures.

3. Moving pictures.

4. Audio media.

5. Written materials.

B. Media by category.

1. Tangible aids. (Valuable for cognitive or psychomotor behaviors but only games and role playing are appropriate for the affective domain.)

a. Objects - provide an opportunity to see, feel, manipulate and use the actual objects connected with the specified objective.

1. Advantages.

a. See the real thing.
b. Takes learning from theoretical to practical level.

2. Disadvantages.

a. Requires considerable preplanning.
b. Acquisition.
c. Storage.
d. Transportation.

b. People - useful aids for instruction, especially in the psychomotor area.

   1. Advantages.

      a. Can provide information otherwise unavailable to the instructor.
      b. Reinforces theoretical learning with statements of practical use.

   2. Disadvantages.

      a. Cost.
      b. Time coordination.
      c. Coordination with objective.

c. Models - may be appropriate when objects under discussion are not readily accessible or are too big, small, complex or expensive.

   1. Advantages.

      a. Makes learning three dimensional.
      b. Gives hands on experience.

   2. Disadvantages.

      a. May be expensive.
      b. Availability.
      c. Storage.

d. Games and gimmicks - ice breakers, closing exercises, problem solvers.

   1. Advantages.

      a. Allow enjoyable learning.
      b. Reinforces concepts.
      c. Helps students to relate to each other and instructor.

   2. Disadvantages.

      a. Time consuming.
      b. Availability.
      c. May diverge from objective.

e. Simulations and role playing - useful in clarifying complex topics and involving participants in the learning process.

        1. Advantages.

           Same as games and gimmicks.

        2. Disadvantages.

           Same as games and gimmicks.

    f. Computers - computer assisted instruction (CAI) is the newest form of teaching tool; preprogrammed instruction is available in many subjects; particularly valuable for drill practice.

        1. Advantages.

            a. Student paced.
            b. Trend for future.
            c. Excellent for drill on basic principles.

        2. Disadvantages.

            a. Expensive unless being used on site for other purposes.
            b. Programs not readily available in environmental subjects.
            c. Require limited computer competence.

2. Still pictures. (Only valuable for teaching cognitive skills)

    a. Photographs -- especially useful for individual study.

        1. Advantages.

            a. Allows individual study.
            b. Good quality available.
            c. Easy to produce locally.

        2. Disadvantages.

            a. Poor for large group discussion.
            b. Cost.
            c. Storage.

b. 35mm color slides - may be used to project a high quality picture for group use. Also, individuals may use a hand viewer.

    1. Advantages.

        a. Locally produced.
        b. Showing order easily changed.
        c. Easily stored.
        d. Used in any sized group.

    2. Disadvantages.

        a. Quality photography required.
        b. Special lighting required.

c. Filmstrips - present a series of slides in a fixed sequence.

    1. Advantages.

        a. Quality finished appearance.
        b. Duplicatable presentation.

    2. Disadvantages.

        a. Cost.
        b. Requires special equipment.
        c. Availability.

d. Overhead transparencies - can project written material, artwork or a photograph with black lines or in color; can be "created" during the instruction.

    1. Advantages.

        a. Leave room lights on.
        b. Easily produced.
        c. Quickly produced.
        d. Instructor controls classroom.
        e. Additions can be made to presentation.
        f. Permanent record.

    2. Disadvantages.

        a. Instructor can become too dependent on overhead.
        b. Rarely well produced.

e. Chalkboard - flexible and inexpensive way to present written material and simple illustrations.

  1. Advantages.

    a. Don't require artist.
    b. Spontaneous; flexible.
    c. Allows student to follow development.
    d. Lights kept on.

  2. Disadvantages.

    a. Not easily repeatable.
    b. No permanent record.
    c. Restricted to smaller groups.
    d. Messy.

f. Charts and posters - for simple instruction, reminders, or to gain attention. Flip charts may be especially useful for on-the-job training.

  1. Advantages.

    Same as blackboard.

  2. Disadvantages.

    a. Similar to blackboard disadvantages.
    b. Storage.

3. Moving pictures. (Useful for teaching all three types of behavior)

  a. Commercially produced 16mm film - a highly attractive and attention-compelling medium, may be used to show motion, illustrate actual events and dramatically re-enact stories and events.

    1. Advantages.

      a. High quality.
      b. Show motion.
      c. Adds realism.
      d. Duplicatable.

    2. Disadvantages.

      a. Cost.
      b. Availability.
      c. Lighting.
      d. Equipment.
      e. Difficult to stop for discussion of important points.

b. Single concept 8mm loop film - provide demonstrations of single skills, processes, events or ideas, are usually silent.

    1. Advantages.

        a. Similar to commercial films.
        b. May be locally produced.
        c. Specific to objective.

    2. Disadvantages.

        Similar to commercial films.

c. Locally produced film - offer many of the advantages of the films described above with the additional capability of presenting instruction tailored directly to instructional needs.

    1. Advantages.

        Same as film loops.

    2. Disadvantages.

        Same as film loops.

d. Instructional television - commercial broadcasts and professionally produced tapes are similar to commercially produced film; they can present more current events as well.

    1. Advantages.

        a. Usually highly polished and professional.
        b. Inexpensive after initial installation.
        c. Recognizable by student.

    2. Disadvantages.

        a. Must be viewed when scheduled.
        b. Not repeatable.
        c. No record.

e. Video tape - video tape units can be used to record events or psychomotor behaviors and replay them immediately for instructional feedback.

  1. Advantages.

    a. Very flexible.
    b. Visual.
    c. Advantages of slides and movies.

  2. Disadvantages.

    a. Expensive.
    b. Not readily available yet.
    c. Often misused.

4. Audio media. (Useful only for cognitive objectives)

  a. Professionally produced audio materials - present professional musicians, poets, historians and other national or international figures for individual or group use.

    1. Advantages.

      a. Allows presentation of sound information.
      b. Inexpensive.
      c. Readily available.

    2. Disadvantages.

      Similar to those of instructor/student exchanges.

  b. Locally produced audio materials - can present special instructions, guest presentations and student presentations; are flexible and inexpensive to use.

    1. Advantages.

      Similar to above.

    2. Disadvantages.

      Similar to above.

5. Written Materials. (Very useable for teaching cognitive skills but limited usefulness for affective and psychomotor skills).

   a. Text and reference books - present detailed information which is easily accessible and can be studied at an individual's own pace.

      1. Advantages.

         a. Permanent record.
         b. Readily available.
         c. Relatively inexpensive.
         d. May be referred to after instruction is completed.

      2. Disadvantages.

         a. Requires basic reading ability and comprehension.
         b. Time consuming.
         c. Retention short.

   b. Workbooks - allow for practice of procedures and other learning events where learners can respond in writing to presented problems and often receive direct feedback immediately.

      1. Advantages.

         a. Similar to books.
         b. Provide practice.

      2. Disadvantages.

         Similar to books.

   c. Periodicals - are especially useful for presenting current information.

      1. Advantages.

         a. Similar to books.
         b. More timely than books.

      2. Disadvantages.

         Similar to books.

d. Teacher produced handouts - useful for supplying specific instructions on instructional activities and supplemented information; are also used to evaluate learning.

   1. Advantages.

      a. Similar to books.
      b. Supplement readily available materials.
      c. Specific.

   2. Disadvantages.

      a. Similar to books.
      b. Easily misplaced.

e. Programmed notes - vital to allow students to devote their full attention to a source of information rather than having to concentrate on taking notes.

   1. Advantages.

      a. Similar to books.
      b. Participatory.

   2. Disadvantages.

      Similar to handouts.

UNIT EIGHT: SELECTING MEDIA FOR INSTRUCTION
LESSON 2 of 5: INTRODUCTION TO TYPES OF TRAINING AIDS

Assignment 8.2 - Media Choices

Directions:

List three objectives that you teach or want to teach. List two types of media that could be used in this subject area. Choices will be discussed following completion.

Subject	Media
1. ______________________	______________________
	______________________
2. ______________________	______________________
	______________________
3. ______________________	______________________
	______________________

Assignment 8.2 - Exercise

Directions:

This assignment provides practice in selecting media for instruction. The technique used to select media requires the behavior expected of the learner to be classified as either Cognitive: knowledge, Cognitive: comprehensive, Cognitive: application, Cognitive: problem solving, Psychomotor, or Affective.

On the following page is a list of "education needs" which have not been classified.

1. Determine the type of behavior called for. For information on how to classify behavior, review Assignment 5.3 - Types and Levels of Objectives
2. Read the row of the Media Selection Table which corresponds to the behavior category to find out which of the five categorical media may be useful. For some behaviors more than one medium may be appropriate.
3. Choose one preferred and at least one alternate kind of media appropriate for the type of behavior involved.

Be prepared to defend your choices in a group discussion.

MEDIA SELECTION TABLE

Types of Behavior

Categories of Media	Cognitive	Psychomotor	Affective
TANGIBLE AIDS			
Objects	E	G	P
People	E	E	F
Models	E	G	P
Games and gimmicks	E	G	G
Simulate, and role play	E	G	E
Computers	E	P	P
STILL PICTURES			
Photographs	F	P	P
35mm color slides	E	P	P
Filmstrips	G	P	P
Overhead Transparency	E	P	P
Chalkboard	E	P	P
Charts and posters	G	P	P
MOVING PICTURES			
Commercial 16mm movie	G	G	G
8mm loop film	G	G	F
Local film	E	E	G
Instructional TV	E	F	P
Video tape	E	G	P
AUDIO MEDIA			
Professional tape	G	P	P
Local tape	G	P	P
WRITTEN MATERIALS			
Books	E	F	P
Workbooks	E	F	P
Periodicals	G	F	F
Handouts	G	F	P
Programmed Notes	G	G	P

Legend:
E = Excellent
G = Good
F = Fair
P = Poor

EXERCISE

Suppose each of the following items describes educational needs of students in your class. What instructional medium would you use to help these students reach desired learning outcomes? Use the Media Selection Table as an aid in completing this exercise.

1. My students must be able to check automatic flow recording equipment for correct operation.

2. My students must know fifteen conversion factors commonly used in day-to-day treatment operations.

3. My students must be courteous to other employees.

4. My students need to understand the internal construction of a large piece of plant equipment.

5. My students must know how to determine settleable solids, ml/liter.

UNIT EIGHT: INSTRUCTIONAL MEDIA AND RELATED RESOURCES
LESSON 4 of 5: SOURCES OF TRAINING MATERIALS

Content Outline

I. Instructional Resources Information System (IRIS).

A. Introduction

1. Nature of IRIS.

IRIS is a computer-based information system managed by U.S. EPA Instructional Resources Center (EPA IRC) which acquires, reviews, indexes, and announces both print and non-print instructional materials.

IRIS currently lists information about 10,000 printed or audio/visual instructional resources which are available from various individuals, state and federal government agencies, educational institutions and commercial companies throughout the country. Materials selected to be announced in IRIS must be available.

2. Purpose of IRIS.

The purpose of IRIS is to provide a central source of information about available instructional materials related to wastewater treatment, water quality and pesticide education and instruction.

3. Locating material in IRIS.

The user can locate information about the resources contained in IRIS by manually searching the collection or by a computer search of the collection. Following are the details of both kinds of searches.

B. Locating material in IRIS by manual search.

1. Source of information.

A "Compilation of Abstracts to Water Quality and Water Resources Materials" is available in either paper copy from the U.S. EPA IRC, The Ohio State University, 1200 Chambers Road, Room 310, Columbus, Ohio 43212.

2. IRIS Resumes.

The IRIS Compilation has resumes of information about every resource in the collection. As applicable, the following items of information are provided in the resume for each resource.

a. Accession Number - the identification number. All identification numbers for items in IRIS begin with the letters, EW.

b. Publication Date

c. Title

d. Author(s) - (not applicable in the "Sample".)

e. Institution where prepared - a sponsoring agency may be cited.

f. Availability - where the material can be obtained.

g. Descriptors - subject terms which characterize the content and form of the materials. Major descriptors are preceded by an asterisk.

h. Descriptive notes - various items of information like the number of pages in a printed resource, the kind of binding, the price as quoted at the time the item was entered into the IRIS collection, etc.

i. Abstract - a brief description of the contents of the resource.

j. ERIC information

   Some of the resources in the IRIS collection are also entered in the Educational Resources Information Center (ERIC) collection. (ERIC is another, more extensive national information system designed and developed by the National Institute of Education.)

   1. Items entered in both systems will have an IRIS (EW) and also an ERIC (ED) identification number; the EW number however, does not appear in Resources in Education.

   2. For items in the ERIC system, the resume includes a note, "ISSUE," which tells where to find the ERIC write-up of the item. In the sample, the reference is to an ERIC publication, Resources in Education, (RIE).

3. Locating resumes of interest.

   a. Manual scan - A person can scan through the resumes in the IRIS Compilation to locate resources which meet particular instructional needs.

   b. Subject index - The compilation also contains a list of the subjects (descriptors) of the resources and the IRIS identification number for the related resource. Then the resume can be easily located to provide details about the resource.

   c. Author index - A user may know the author of a resource. An author index to IRIS identification numbers is in the Compilation.

   d. Title index - This contains all the titles entered in the Compilation.

C. Obtaining copies of resources.

The resume for the resource contains information about the source and cost of the resource.

1. Printed materials:

   These are available in one or both of two forms.

   a. Hard copy - paper similar to Xerox copies.

   b. Microfiche - 4" x 6" sheets of microfilm on which up to 96 pages of text are reproduced. The microfilm can be enlarged and copied page for page on reader-copier equipment.

2. Audiovisual materials.

   As applicable, the source for purchase of audiovisuals is given as part of the resume.

D. Locating materials in IRIS by computer search.

1. Access database for IRIS.

   CompuServe is the database vendor serving as the access to the computer tapes of the IRIS Collection. For a modest fee, you can arrange to have a computer search of IRIS according to your needs.

2. Access databases for ERIC.

   Many IRIS resources are also entered in the ERIC System which includes a computer tape of that collection. BRS, Systems Development Corporation, Dialog, and CompuServe are current vendors of computer searches of the ERIC tapes.

3. Information about locations to access databases.

   Contact the EPA IRC for information.

4. Obtaining copies of resources.

   After choosing resources from the resumes provided by a computer search, the procedure for obtaining copies is the same as in manual searches.

IRIS Sample Abstract

Entry in IRIS Only

EW003821

PUBLICATION DATE: (78)

TITLE: WPCF Wastewater Treatment Plant Operator Training Program, Intermediate Course: Student Workbook, Vol. A, Parts 1 and 2.

AVAILABLE FROM: Water Pollution Control Federation, 2626 Pennsylvania Ave., Washington, D.C. 20037

DESCRIPTOR: *Activated Sludge; Audiovisual Aids; Certification; *Clarification (Wastewater); Environmental Technicians; *Instructional Materials; Job Skills; *Operations (Wastewater); Pollution; *Post Secondary Education; *Wastewater Collection; *Wastewater Treatment; Water Pollution Control

DESCRIPTIVE NOTE: 244 pages. Course Materials: 35mm slides (340), [illegible] tape cassettes, adminstrator handbook, carrying case, and student workbook (parts 1 and 2) - order no. E0291, $400.00; student workbook only - order no. E0292, $4.50; other volumes: EW003822 and EW003823

ABSTRACT: This document is one in a series of self-instructional workbooks for training wastewater treatment plant operators in the basic functions of facility operation. The workbook contains a pre- and post-test questionnaire for each unit as well as self-tests as interim guides. The units discussed in the volume are a general introduction, the community wastewater system, pre-treatment, clarification, and activated sludge.

Entry in IRIS and ERIC

SE003836 ED157796

PUBLICATION DATE: (71)

TITLE: A Guide to the Common Diatoms at Water Pollution Surveillance System Stations.

PERSONAL AUTHOR: Weber, Cornelius I.

INSTITUTION CODE: BBB06755

INSTITUTION NAME: Environmental Protection Agency, Cincinnati, Ohio

AVAILABLE FROM: EDRS Price MF-$0.83 HC-$6.01 PLUS POSTAGE

DESCRIPTOR: Biology; Environment; *Instructional Materials; *Microbiology; *Plant Identification; Post Secondary Education; Science Education; *Taxonomy; *Water Pollution Control; Water Resources; *Diatoms

DESCRIPTIVE NOTE: 107 pages; Graphs may not reproduce well

ISSUE: RIE DEC 78

ABSTRACT: This guide was developed by the United States Environmental Protection Agency (EPA) as a taxonomic reference for the identification of diatoms. The taxonomic information included consists of a generic key to the common genera of diatoms, a section illustrating 164 diatom species representing 43 common genera found at the Water Pollution Surveillance System (WPSS) stations, and an alphabetical list of the genera included in this publication. Related information includes collection and slide presentation procedures, a description of the structure of the diatom cell wall, and a glossary of terms used in diatom taxonomy. Also included is a map of the WPSS station locations in the United States and charts indicating the four most abundant diatom species at these WPSS stations. No information is given on the ecology of diatoms. (MR)

II. Information Resource Center (IRC)

A. The nature of IRC.

One of the results of the current national concarn about pollution control has been the development of numerous publications and instructional programs designed to assist education and training personnel. Published documents by federal agencies, state agencies, educational institutions, and public interest groups address pollution control issue from a variety of perspectives. A review of the instructional materials available indicates that some duplication exists, and more significantly, there is a limited awareness of available resources by educators and trainers.

To assist with coordination and dissemination of educational information, the EPA's National Training and Operational Technology Center (NTOTC) formed the Instructional Resources Center (IRC) in 1978. With 1981 budget cuts, NTOTC ceased to exist and the IRC project was transferred to The Ohio State University.

The IRC provides instructors with a systematic mechanism to obtain EPA-developed courses and programs as well as materials produced by other sources.

B. Purposes of IRC.

A major purpose of the IRC is to avoid unnecessary duplication of effort so available resources can be more effectively and efficiently used.

All IRC goals are intended to facilitate pollution control instruction by either incorporating quality materials into existing curricula or introducing new courses of study.

C. Components of IRC.

1. IRC viewing facilities.

Audiovisual preview facilities are maintained at the IRC. A variety of equipment is maintained to allow users to try various media and materials prior to allocating funds for purchases. A fee is charged for using the preview facilities, but these charges can be applied to the purchase of A/V materials.

In addition, sample copies of printed water quality and pesticides education/training materials are maintained and available for review.

2. IRC rental library.

The purpose of this component is to rent audiovisual instructional units to education and training organizations to support classroom activities.

Most of the units were developed to be used in EPA conducted courses and are not designed to be self-instructional. Rather, they are training tools to be used in an integrated presentation of a topic. Topics range from statistical analysis of pollution data to chemical and biological laboratory procedures.

Catalogs are available and are distributed on request. Materials listed can also be purchased.

3. IRC Bulletin.

The IRC serves as a major communication link with educational and training organizations. One of the methods used to maintain dialogue is the IRC Bulletin. The bulletin is available on a subscription basis ($4.50 per year).

III. National Environmental Training Association (NETA)

A. The nature of NETA.

The National Environmental Training Association (NETA) saw its beginning emerge from a workshop at the Environmental Resources Training Center, Southern Illinois University, in the summer of 1977. The meeting was convened to discuss the problems of environmental manpower development and training programs.

Foremost among needs identified in the meeting was the need for improved communications among individual trainers, educational institutions, training centers, and federal, state, and local agencies. The outcome of the meeting was the formation of a task force charged with the responsibility to draft a constitution for the establishment of a national training association.

A few months later, at the annual meeting of the Water Pollution Control Federation in Philadelphia, NETA was officially formed.

NETA is the only national association concerned entirely with the needs of environmental trainers.

B. Purposes of NETA.

1. Improved communications among individual trainers, training agencies and institutions, and governmental agencies.
2. Identification, development and evaluation of training aids to support environmental control facility personnel training.
3. Promotion of minimum standards for environmental control facility personnel training and the encouragement of reciprocity between states and training institutions for the transfer of credits.
4. Promotion of professionalism among environmental control facility personnel and the encouragement of qualified persons to enter the environmental control field.
5. Promotion of public awareness of the benefits of training for effective operation and maintenance of environmental control facilities.
6. Promotion of environmental control facilities as a community socioeconomic resource to attract development and stimulate growth.

C. Components of NETA.

1. Technical assistance and training services are provided at all levels.
    a. Training programs are administered through vocational and technical schools, two-year and four-year colleges, state and local agencies, and consulting firms.
    b. Delivery methods.
        1. On-site hands-on training.
        2. Workshops.
        3. Seminars.
        4. Short schools.
        5. Instruction via closed circuit audio and visual networks.
        6. Correspondence courses.
        7. Self instruction programs.

c. The development and evaluation of curricula and training materials are important functions of the individual and institutional members of NETA.

Expertise in all aspects of curriculum and training materials development is found within the Association.

2. Regional coordinating network.

Each of seven regional coordinators serve as a communication link between the geographical areas in the United States and Canada and the NETA management staff and executive board.

3. Communication.

a. NETA Newsletter and news bulletins.

b. NETA National workshop and conference.

c. Regional meetings.

D. Address for NETA.

NETA
970 Mill Pond Road
Suite A
P.O. Box 346
Valparaiso, IN 46383

IV. Community Sources

A. Definition.

1. Sources of materials, information, and/or expertise available within a community.

2. Levels of resources.

a. State.

b. County.

c. Local (city, village, or town).

B. Types of resources.

1. Water plants.
2. Educational institutions.
    a. Colleges and universities.
    b. Vocational/technical schools.
3. Libraries.
    a. Public and private.
    b. Individual library collections and inter-library loans.
4. Trainees with special expertise.
5. Area environmental training centers.
6. Special interest groups (i.e., Sierra Club).

Content Outline

I. Introduction

Analogy of instruction: The analogy between training and pouring water into a container is removing the lid (preparation), using a funnel (training aid use), pouring the liquid (presentation), and capping the jar (retention).

II. Rules of Visual Aid Use

A. Always prepare before starting.

B. Use visual aids to focus instruction.

C. Give the student the opportunity to do something with the data being presented.

D. Basic steps.

1. Preparation.

a. Instructor preparation by previewing media and lesson plan.

b. Student preparation by reading assigned material and becoming mentally ready to accept new material.

2. Presentation.

"Pouring" of information.

3. Reinforcement.

a. Retention stage.

b. Application of material.

c. Use worksheets, labs, problem solving.

III. Using Specific Aids

A. Films - video, slide shows, film strips, etc. Experience from military training programs show that film media should be viewed three times in a short period and that students don't always learn what you want them to learn.

1. Proper use.
    a. Preparation.
        1. Preview film.
        2. List objectives.
        3. Discuss the film before showing.
        4. Plan to give students something to do with the information in the film after it is completed.
    b. Presentation.
        1. Provide lights so notes can be taken.
        2. Stop the film as necessary to review fast moving segments.
    c. Reinforcement.

        Have students apply the information.
2. Don'ts.
    a. Don't show a film without previewing it.
    b. Don't show a film out of sequence or on the wrong subject.
    c. Don't leave the room during the showing.
    d. Don't rewind the film while students are completing a worksheet.
    e. Don't schedule a film at the end of a session.
    f. Don't show a film without proper opening discussion.
    g. Don't show a film without giving some assignment that allows the participants to use the material presented in the film.

3. Equipment checklist - moving pictures.
    a. Take up reel.
    b. Extension cord.
    c. Screen.
    d. Extra bulb.
    e. Projector positioned so a good sized image is shown.
    f. Have a clear path to the screen.
4. Equipment checklist - slides.
    a. Slide trays.
    b. Sync cord.
    c. Extension cord.
    d. Extra bulb.
    e. Zoom lens.
    f. Screen.
5. Equipment checklist - video tape.
    a. Adapter cords.
    b. Extension cords.
    c. One monitor per 24 students.

B. Diagrams - blackboards, flip charts, transparencies and slides.

It is important to visualize, not to illustrate. Studies have shown that retention of information improves from 20 percent to 50 percent when visualization is used instead of illustration.

1. Use of diagrams.

    a. Plan the board layout.

    b. For slides and overheads, do your own layout then have the artist complete the project.

    c. Insure the visual deals with the objective of the lesson.

    d. Properly align projectors for a square and focused presentation.

    e. When using only a few visuals, explain the purpose of the visual before it is shown.

    f. Use a lighted pointer for slides.

    g. Cover points on overheads that are to be referred to later.

    h. Stand where you are the most comfortable at the screen or at the projector table.

    i. Give students something to do with the information either during or after the lecture.

2. Don'ts.

    a. Don't write long sentences that you want students to copy.

    b. Don't make a list without a heading - students will lose their place.

    c. Don't change subjects without erasing the blackboard.

    d. Don't use words when a visual would be better.

    e. Don't proceed without preplanning.

    f. Don't read a list of data or verbally try to describe how to solve a math problem - use the blackboard.

    g. Don't use small visual images.

    h. Don't place too much material on a visual.

3. Blackboard and flip chart use.

    a. Don't worry about handwriting.

    b. Use the blackboard for listing student responses.

    c. Preplan their use.

    d. Visualize.

    e. Spell words correctly.

4. Word visuals - slides and transparencies.

    Slides and transparencies should be used when you must because of time, money and logistical considerations.

    a. Identify the objective of the lesson.

    b. Use 24 point type or larger (there are 72 points in an inch).

    c. When using slides, type the words with a proportional space typewriter.

    d. Make one visual for each point that you want to cover.

    e. Place overheads in frames.

    f. Number the overheads.

    g. Place note pages between overheads.

    h. With slides, make a description list of all the slides in the program for your use.

    i. Use programmed notes or worksheets to reduce student note taking time.

PROGRAMMED NOTES

1. In the training process, removing the lid is similar to

_______________________.

2. The funnel is considered a ________________ ______________________.

3. The pouring of the fluid is similar to the ______________________.

4. Putting the lid on causes _____________________.

5. Rules of using visual aids would include:

   a. Always ________________ before you start

   b. using visual aids to ______________________ on the instruction

   c. and giving the student ______________________.

6. Three basic steps to a good visual lecture would be:

   a.

   b.

   c.

PROGRAMMED NOTES KEY

1. Preparation

2. Visual or Training Aids

3. Presentation

4. Retention

5. a. Prepare
   b. Focus
   c. Something to do with the information on the film after the film has been viewed.

6. a. Preparation
   b. Presentation
   c. Retention

UNIT NINE
LESSON PLANNING - Unit Overview

Overview:

Lesson planning is the final stage in designing instruction. It involves the preparations for the actual delivery of the instruction to learners. This unit presents nine rules for making instruction effective and efficient and teaches participants to use the IPW as a plan for delivering instruction.

Objectives:

LESSON 1: Participants will describe the kinds of activities involved in completing an Instructional Package Worksheet.

LESSON 2: Participants will define and give an example of the application of each of the nine rules for effective instruction, and will select or create components of a hypothetical lesson which exemplify the nine rules.

LESSON 3: Participants will plan a lesson and complete an IPW for that lesson. Given an IPW, participants will specify entering competencies, justification, objective, an instructional approach, and resources to teach the lesson.

Resources:

LESSON 1: -Content Summary

LESSON 2: -Assign. 9.1 - Principles of Instruction

LESSON 3: -Assign. 9.2 - Exercise in Planning a Lesson.
-Instructional Package Worksheet

UNIT NINE: LESSON PLANNING
LESSON 1 of 3: OVERVIEW

Content Outline

I. The Instructional Package Worksheet

- A. Components.
    - 1. Entering Competencies.
    - 2. Justification.
    - 3. Objective.
    - 4. Evaluation Activities.
    - 5. Resources.
    - 6. Instructional Approach.

II. The IPW as a Lesson Plan

- A. A lesson plan describes in detail and in order what must be done to teach a single objective.
- B. What a lesson plan specifies.
    - 1. What trainees must know or be able to do before they begin the lesson.
    - 2. Why this particular skill or knowledge is important.
    - 3. What trainees will do as a result of learning.
    - 4. How the learning will be assessed.
    - 5. What materials and equipment the instructor will use to teach the lesson.
    - 6. What the instructor will do to help trainees learn.

III. Purpose of a Lesson Plan

A. Organization.

Writing down exactly what you plan to do in the order you plan to do it helps you to organize the instruction. It helps you decide when to incorporate media, when to provide practice, and when and how to give feedback.

B. Creation of a permanent record.

Once written down, lesson plans are reusable; they can be shared with other instructors who must teach the same skills, thus helping to avoid needlessly "reinventing the wheel."

C. Answering demands for accountability.

A lesson plan is evidence of what happened during a lesson. It can help in the planning of future lessons by identifying instructional techniques that are effective or ineffective in particular situations.

IV. Completing the Instructional Package Worksheet

A. Specify the entering competencies.

B. Provide a justification for the objective.

C. State the objective.

D. State the evaluation activities.

E. List the resources needed to carry out instruction.

F. Describe the instructional approach.

V. Specifying Entering Competencies

A. Definition: Skills and knowledge that trainees must possess before they are ready to learn the behavior specified in the objective.

B. Task analysis as means of determining prerequisites.

C. Insuring trainees possess prerequisite capabilities.

1. Pre-testing.

2. Remedial instruction.

VI. Providing a Justification for the Objective

Provide a rationale for trainees which explains why the objective is important. The justification should refer directly to the occupational use of the skill or knowledge described in the objective.

VII. Stating the Objective

VIII. Stating the Evaluation Activities

IX. Listing the Resources Needed to Carry Out Instruction

A. Definition: Anything an instructor or trainee uses during instruction is a resource.

B. In Unit Seven, available resources were identified and used to select instructional methods. Those resources must now be matched with the activities they support and other necessary resources identified and prepared.

1. Prepare content outlines for lectures.

2. Write specific questions for guided discussions.

3. Select/prepare instructional support materials.

a. Figures, slides, films.

b. Handouts.

c. Demonstration materials and equipment.

4. Select/prepare trainee materials.

a. Readings.

b. Exercises.

c. Worksheets.

d. Tests.

e. Procedural manuals.

C. List resources on the Instructional Package Worksheet.

1. Content outline/discussion questions.

2. Figures.

3. Assignments.

4. Media (materials and equipment).

X. Describing the Instructional Approach

A. Definition: The sequence of activities which an instructor uses to teach a lesson.

B. Methods and activities.

1. Activities describe the means by which instructional methods are carried out, (e.g., if the method is lecture, the activities will be: (1) delivers lecture, (2) shows figures on overhead projector, and (3) distributes handouts.

2. Methods are the source of activities.

3. Activities should be listed briefly, succinctly, and in order.

C. The process.

1. List activities in terms of the methods selected.

2. For each method, identify all activities that will be needed to implement the method.

3. Describe the activities in terms of what the instructor must do.

XI. Reviewing the Instructional Package Worksheet

A. Review the Instructional Package Worksheet prior to teaching the lesson to insure the IPW contains all information necessary to teach the lesson.

B. Review the Instructional Package Worksheet after teaching the lesson.

1. Note any particularly effective activities and materials.

2. Revise the Instructional Package Worksheet to eliminate/modify ineffective activities and materials.

LESSON NINE: LESSON PLANNING
LESSON 2 of 3: PRINCIPLES OF INSTRUCTION

Assignment 9.1 - Principles of Instruction

This assignment introduces you to nine principles for planning effective instruction. Each principle is explained and illustrated. An exercise accompanies each principle so you can try out your understanding of the principle as you learn it. Answers to the exercises are provided for you as a progress check at the end of the lesson.

Some exercises have no single correct answer but rather a range of answers are correct. In the answer key, you will find a suggested or representative answer. Your answer should be similar to the one suggested. If you miss more than one question in an exercise, review the principle, the explanation, and the example. When you understand your mistake, go on to the next principle. Ask your instructor if you don't understand an answer or if you have a question about the principle.

The purpose of this lesson is to pull together ideas from the first eight units into a single set of rules which you should follow as you plan a lesson. Review of these rules serves to emphasize the importance of these rules as the basic guidelines for presenting a lesson effectively.

Directions:

1. Complete the readings, exercises and post-test on the following pages. This task should take approximately 60 minutes.
2. Discuss the post-test. This task should take approximately 15 minutes.

RULE #1: GOOD INSTRUCTION BEGINS WITH AN EXPLANATION OF WHY THE NEW SKILL OR KNOWLEDGE IS IMPORTANT

EXPLANATION: When learners are made aware of the relevance or importance of the new knowledge or skill, there will be greater motivation for learning.

APPLICATION: Giving learners reasons for learning may involve telling them the new skill is required for a higher-level position, or the new knowledge will help them to perform present job tasks more efficiently. The reason motivates trainees to learn.

EXAMPLE: The average eight-year-old boy may have no interest in learning arithmetic. However, if the child discovers that, in order to obtain a paper route, he must be able to make change quickly and correctly, his interest in learning arithmetic will increase. Obtaining a paper route serves as motivation for learning arithmetic.

EXERCISE #1: Place an x next to each statement that is a good example of an instructor's explanation for a lesson.

______1. Learning to balance these figures is the first step in learning the bookkeeping system. Clerks on the next three job levels above this one must know this bookkeeping system.

______2. Your job may never require you to run this test, but the procedure is quite interesting.

______3. This material is required of all students in this course.

______4. A knowledge of FORTRAN computer language is essential in programming this computer. You will probably use FORTRAN many times each day in your job.

______5. Since many of your co-workers on this project do not speak English, the company is offering this course in conversational French to help you communicate with your co-workers.

RULE #2: GOOD INSTRUCTION INCLUDES A PRECISE DESCRIPTION OF WHAT THE LEARNER WILL DO AFTER INSTRUCTION

EXPLANATION: Trainees need to know what the goal or object of instruction is so they can separate what they must know from what is nice to know. Specifying the skill or knowledge that will result from instruction is one way of informing trainees of the goal.

APPLICATION: Instructional objectives gives trainees both a goal to work toward and a standard against which they can judge their ability. Specifying instructional objectives also aids the instructor in directing the instruction toward the specific goals.

EXAMPLE: Participants in the Basic Instructional Technology Workshop have been told that one objective of the workshop is that they use the nine rules for effective instruction to plan a lesson. The participants know they must apply the nine rules; merely stating the rules or giving explanations for them is not sufficient. The instructional objective specifies a precise goal for learning.

EXERCISE #2: Put an x next to each statement which provides a clear goal for learners.

______1. After completing this lesson, you will know about nine rules for planning instruction.

______2. By the end of this unit, you will be able to test water samples for the presence of mercury, using standard equipment.

______3. When you finish this unit, you will understand instructional objectives.

______4. When they have completed the basic workshop, participants will be able to plan a lesson.

______5. The purpose of this lesson is to teach you about evaluation.

RULE #3: GOOD INSTRUCTION INSURES THAT THE LEARNER IS READY TO BEGIN LEARNING

EXPLANATION: Learners must possess certain basic skills and knowledge before they can successfully learn more complex things. The basic abilities are thus PREREQUISITES for the complex abilities. The instructor must make certain that learners have these prerequisite abilities and are therefore ready to begin learning more complex skills and knowledge.

APPLICATION: You can determine whether trainees are ready to begin learning by evaluating the degree to which they possess prerequisite abilities. The evaluation can be highly informal, such as a brief discussion. Trainees who lack prerequisite skills or knowledge may need to be provided with instruction on the abilities they lack before they can begin to learn new or more complex ablities.

EXAMPLE: Before your instructor can help you learn how to select instructional methods, he must be certain you know how to specify instructional objectives and classify instructional resources. Therefore, the prerequisite abilities for learning to select methods are writing objectives and classifying resources. To determine whether the participants are ready to begin learning the procedure for method selection the instructor may give a quiz on the prerequisite abilities. Those who do not pass the quiz will be asked to study material on the prerequisite skills.

EXERCISE #3: For each of the following tasks, identify two prerequisite abilities which learners must have before they can learn the task.

1. Repack a pump.

   ______________________ ______________________

2. Change chlorine cylinders.

   ______________________ ______________________

3. Troubleshoot the aeration tank.

   ______________________ ______________________

RULE #4: GOOD INSTRUCTION USUALLY MOVES FROM THE WHOLE TO THE PART AND FROM THE GENERAL STATEMENT TO THE SPECIFIC DETAIL

EXPLANATION: Learning requires understanding. Many learners have difficulty when only a part of an idea or a single detail is presented. To succeed, they must have access to the whole concept or procedure or rule before they can understand the parts.

APPLICATION: Begin each lesson by stating the whole concept, rule, or procedure to be learned. Then present specific details, steps, and illustrations. Do not give examples until after the whole idea has been taught.

EXAMPLE: In Unit One of the Basic Workshop, you were shown a general five-part model of the procedure for designing instruction. That model represents the whole process you will learn during the workshop. Each of the next six units represents a part of that whole process; for example, the first part you studied was problem definition. Within each unit, individual lessons present specific details of the process. For example, one detail involves using the Instructional Package Worksheet. Thus, the entire workshop has been designed in terms of a general-to-specific sequence.

EXERCISE #4: You have been asked to teach a basic lesson on wastewater treatment. Listed below are some topics you wish to include in the lesson. For each pair of topics, put an x beside the topic you would teach first.

______1. Physical characteristics of wastewater.

______2. Normal winter temperature of influent wastewater in Wyoming.

______3. Normal flow through an activated sludge plant.

______4. Equipment in the aerated grit chamber.

______5. Control systems in treatment plants.

______6. Mechanical control systems.

RULE #5: GOOD INSTRUCTION PROVIDES A VARIETY OF LEARNING EXPERIENCES

EXPLANATION: Some people learn by listening to lectures; some prefer to discuss ideas and ask question; still others need to see visual representations such as diagrams and pictures. People learn differently.

APPLICATION: A good instructor considers these differences and provides instruction in a variety of ways. A lecture can be supplemented with visuals such as charts and graphs. A reading can be followed by a discussion. The repetition that occurs when several methods are combined is important. Repetition leads to better and more lasting retention.

EXAMPLE: To teach participants how to write instructional objectives, an instructor decides to use a lecture. However, since a variety of instructional methods provides important repetition, the instructor also plans to use overhead transparencies and handouts which diagram the process of writing objectives. The instructor also plans to have a discussion on the difficulties in writing objectives. Finally, the instructor will assign a reading to reinforce the other presentations. By using a variety of methods, the instructor makes certain that the needs of all learners are met.

EXERCISE #5: List 2-3 ways in which an instructor might provide variety during a lesson on each of the following three topics.

1. Using a analytical balance.

________________ ____________________ __________________

2. Performing a task analysis.

________________ ____________________ __________________

3. Maintaining valves.

________________ ____________________ __________________

RULE #6: GOOD INSTRUCTION INCLUDES EXAMPLES

EXPLANATION: Examples are concrete and specific illustrations of general ideas. They connect abstract words to the real world. Examples show learners how rules and procedures work.

APPLICATION: Examples include demonstrations of procedures, applications of formulas and rules, and illustrations of concepts. Examples reveal how procedural steps should be carried out and how formulas and rules should be used. To be most useful, examples should move from easy to difficult. Whenever possible, more than one example should be used to teach a single procedure or rule or concept.

EXAMPLE: The design of this assignment involved the application of the rule for including examples. After each rule for good instruction is presented, an example is given so that the participants can see how to implement the rule. The example makes concrete and specific the general statement of the rule.

EXERCISE #6: Identify four instances of the uses of examples in teaching the concepts of this workshop.

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

RULE #7: GOOD INSTRUCTION INCLUDES OPPORTUNITIES FOR LEARNERS TO PRACTICE WHAT THEY ARE LEARNING

EXPLANATION: Practice opportunities allow learners to try out new abilities and to discover what they don't understand. Practice aids both in increasing retention and in transferring the new skill or knowledge from the classroom to the real world.

APPLICATION: Practice opportunities should be included for each separate concept or rule or procedure being taught. Frequent opportunities should be provided for practice during instruction. Several short sessions of increasing levels of difficulty are far more effective than a single lengthy session at the end of a lesson. Learners can gain practice by discussion of ideas, using formulas and rules to solve problems, and carrying out procedures.

EXAMPLE: The design of this reading illustrates the rule that good instruction includes opportunities for practice. As each rule is presented and explained, you are given an opportunity to try out your new knowledge. An exercise allows you to practice using the rule to determine how well you understand the rule. Several short sessions are provided, one for each rule.

EXERCISE #7: As a wastewater treatment plant chemist, one of your duties involves teaching technicians to perform routine chemical tests. Each of the two paragraphs below describes an approach to teaching a test procedure. Put an x beside the paragraph that describes the more effective use of practice.

______1. The instructor lists the steps in the procedure and then demonstrates the procedure. Next, the instructor asks one trainee to list, in order, the steps involved. Then, the instructor demonstrates the procedure again, commenting on important concerns or cautions associated with each step. Finally, the instructor asks each trainee to carry out the procedure on a wastewater sample.

______2. The instructor lists the steps in the procedure. As he demonstrates each step, he asks a trainee to state what is involved in the step. Next, the instructor asks one trainee to demonstrate the procedure under the direction and guidance of the other trainees. Then trainees work in pairs to criticize each other as they carry out the procedure. Finally, each trainee is given three wastewater samples and asked to perform the test and report results for each sample.

RULE #8: GOOD INSTRUCTION PROVIDES ONGOING FEEDBACK SO LEARNERS KNOW HOW WELL THEY ARE LEARNING

EXPLANATION: Feedback is knowledge of results. Feedback can be as simple as "Right/Wrong" response from the instructor. Or it can involve detailed explanations of why answers are wrong and directions for correcting the answers. Feedback serves two important purposes. First, it tells the learner how well he is doing so the learner knows how to correct errors and increase learning. Second, feedback motivates the learner to try again.

APPLICATION: Feedback should be both explanatory, motivating, and corrective. You should provide both correct answers and encouragement. Praise is an important part of feedback; it can take the form of a compliment as well as a high score on an exercise or test. Feedback should also be provided frequently. Each exercise or activity should include a feedback component. Most important, feedback should be constructive; it must never attack a learner personally and it must be specific in identifying errors and suggesting solutions.

EXAMPLE: Robert's mother is teaching him to bake bread. She describes the process, gives Robert a recipe, and demonstrates the process. When Robert adds the yeast to cold water, she tells him that the yeast will not develop and shows him how warm the water should be. When Robert kneads the dough, she compliments him on his firm touch. And when the bread is out of the oven, she proudly serves it to the family. She has demonstrated the process of providing ongoing feedback so Robert can correct his mistakes and feel confident about his successes.

EXERCISE #8: Place an x next to each example of effective feedback.

______1. Your test score was 70 out of a possible 80. Good work!

______2. You incorrectly stated one part of the objective; find your error and correct it.

______3. That's a stupid comment!

______4. You seem to be having trouble understanding the concept of evaluation. Reread Unit Five and mark the parts you don't understand; then come talk with me.

______5. You are holding that beaker wrong. That's why you are having trouble seeing the sediment.

RULE #9: GOOD INSTRUCTION CONSIDERS THE TYPE AND LEVEL OF BEHAVIOR SPECIFIED IN THE INSTRUCTIONAL OBJECTIVE

EXPLANATION: Instruction must be directed toward the type and level of behavior specified by the objective which the kinds of learning experiences trainees must have in order to perform as the objective specifies.

APPLICATION: Psychomotor objectives require instruction in physical (motor) skills; verbal descriptions of physical movements are not sufficient. The learner must be able to practice the type of performance that he will have to demonstrate during the evaluation.

Affective objectives necessitate experiences which provide models for the desired behavior. Learners must see others demonstrate desired attitudes and must have opportunities to practice the behaviors on which they will be evaluated.

Different levels of cognitive objectives require different kinds of learning experiences. To perform at the knowledge level, the learner must have access to verbal information and practice in stating that information. To perform at the Comprehension level, he must have instruction and practice in explaining, classifying, etc. Application-level performance is developed through experience involving using rules and formulas and carrying out procedures. Problem-solving abilities are developed through exposure to problem situations which allow learners to practice generating and testing solutions.

EXAMPLE: To teach participants how to write instructional objectives, the instructor provides several types of learning experiences. He defines the concept "objective" shows examples of properly written objectives, describes the procedure for specifying the four components, and provides participants with practice in writing the objectives. Since the level of performance specified in the objective is at the Application level, the instructor knows that participants must have training and practice in applying the formula and writing sample objectives.

EXERCISE #9: For each of the following objectives, name the most important kind of learning experience that trainees would need in order to perform the type and level of behavior specified in the objective.

1. Uses an analytic balance to weigh a substance.

2. Explains the importance of specifying an acceptable performance level in an instructional objective.

3. Types a report from a written copy.

ANSWER KEY

EXERCISE #1: X's should be placed on numbers 1, 4 and 5.

EXERCISE #2: X's should be placed on numbers 2 and 4.

EXERCISE #3: Suggested responses:

1. Repack a centrifugal pump.

   identify the correct packing to use
   break down pump

2. Change chlorine cylinders.

   identify the parts of the chlorinator and cylinder
   list the safety rules

3. Troubleshoot the aeration tank.

   identify normal conditions in the tank
   identify normal influent characteristics

EXERCISE #4: X's should be placed on numbers 1, 3 and 5.

EXERCISE #5: Suggested responses:

1. Using an analytical balance.

   lecture or film
   demonstration

2. Performing a task analysis.

   lecture demonstration
   individualized learning package

3. Maintaining valves.

   film reading demonstration

EXERCISE #6: Responses are:

1. All demonstrations are examples.
2. Each rule in this assignment has an example.
3. The simulation exercise is an example.
4. The exercises in this assignment contain examples.

EXERCISE #7: Number 2 should be marked.

EXERCISE #8: X's should be placed on numbers 1 and 4, 2 and 5 are less positive but in a generally motivating environment they are acceptable. Item 3 is of no value.

EXERCISE #9: Possible responses:

1. Uses an analytic balance to weigh a substance.

   practice in following the procedure

2. Explains the importance of specifying an acceptable performance level in an instructional objective.

   oral or written practice in explaining

3. Types a report from a written copy.

   practice in using typewriter

POST TEST

You have been asked to teach a lesson on writing behavioral objectives. The purpose of the lesson is to help students learn how to identify the type and level of behavior for each objective. All the following questions involve applications of the nine rules to the design of this lesson.

1. State two instructional objectives for the lesson.

2. Put an x beside the statement which best explains why learners should master the objective.

   ______a. The training supervisor always wants to see lesson objectives.

   ______b. Objectives tell students what they will do when they have learned.

   ______c. Objective-writing is a fascinating skill to study.

3. List at least three prerequisites for this lesson.

4. a. List at least four instructional methods that can be used to teach the lesson.

   b. Briefly describe how you would provide examples, practice opportunities, and feedback.

5. Briefly explain how you would prove that the lesson appropriate for the domain and the level of performance specified in the objective.

UNIT NINE: LESSON PLANNING
LESSON 3 of 3: EXERCISE IN PLANNING A LESSON

Assignment 9.2 - Exercise in Planning a Lesson

This assignment is designed to give you practice in specifying instructional activities and identifying instructional resources for a single lesson. Using a step from a task you are familiar with, you will complete an Instructional Package Worksheet (IPW) for a lesson. You will have approximately 45 minutes for this task. The remaining 15 minutes will be spent in a discussion of any problems or concerns involved in specifying instructional activities and resources for a lesson.

Directions:

1. Complete the exercise described below. You may write your lesson around a step from a task you are familiar with. This task should take approximately 45 minutes.

2. Discuss completed Instructional Package Worksheet with fellow participants. This task should take approximately 15 minutes.

EXERCISE DESCRIPTION

You have already completed initial plans for teaching a lesson on a topic. You are now ready to develop the lesson activities. Using the Instructional Package Worksheet which is included here, you will complete it for a 60 minute lesson on the step you have chosen. The Instructional Approach should contain detailed instructions on kinds of instructional and learning activities. Your Instructional Package Worksheet should be complete enough that any other instructor with experience and responsibilities similar to yours will be able to teach the lesson using the Instructional Package Worksheet. You should also indicate specific kinds of resources that should be used in the conduct of the lesson, such as figures, handouts, content outlines, and the like. Be prepared to explain and justify your decisions during the discussion which completes the assignment.

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM:

COURSE:

UNIT:

LESSON:

Estimated time:

Entering competencies:

Justification:

Objective:

Evaluation Activities:

Resources:

Instructional Approach:

UNIT TEN
DEVELOPMENT OF PRESENTATIONS - Unit Overview

Overview:

The development of good teaching skills requires practice. In this unit, participants have the opportunity to apply many of the skills they have learned throughout the workshop. Each participant defines the objectives, develops evaluation items, and designs the instruction and supporting figures for a 15 minute lesson. These lessons will be presented and evaluated as part of the conduct of Unit Eleven.

Objectives:

NOTE: Participants will complete only one of the two lessons offered here depending on the way they will instruct in the future.

LESSON 1: (Speakers only) Given one of the completed IPW's in the Participant Reference Manual, the student will apply the principles of the workshop in completing the justification, evaluation activities, resources and instructional approach sections, developing visual aids and presenting a 15 minute lesson.

LESSON 2: (All other participants) Workshop participants will define an objective, design evaluation items, plan the instruction (including the preparation of an Instructional Package Worksheet) and prepare a presentation of one lesson on a topic of their choice. Finally, when delivered, the presentations should exhibit the characteristics of good teaching and presentation skills.

Resources:

LESSON 1: -Partially Completed Instructional Package Worksheets

-Acetates and felt pens
-Other materials and media as determined by participants

LESSON 2: -Instructional Package Worksheet blank

-Acetates and felt pens
-Other materials and media as determined by participants

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM: Environmental Technology.

COURSE: Introduction to Environmental Technology.

UNIT: I: Introduction.

LESSON: 1 of 5: Natural Cycles.

Estimated time: 10-15 minutes.

Entering Competencies: None.

Justification:

Objective: From memory, the student will draw a diagram of the hydrologic cycle and label five parts to include:

1. Precipitation.
2. Evaporation.
3. Percolation.
4. Infiltration.
5. Transpiration.

Evaluation Activities:

Resources:

Instructional Approach:

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM: Environmental Technology.

COURSE: Introduction to Environmental Technology.

UNIT: II: Epidemiology.

LESSON: 2 of 3: Enteroviruses.

Estimated time: 10 minutes.

Entering Competencies: Students must be able to describe the relationship between epidemiology and environmental protection.

Justification:

Objective: From memory, the student will define epidemiology and list four major problems which block the effective removal of enteroviruses from the environment.

Evaluation Activities:

Resources:

Instructional Approach:

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM: Environmental Technology.

COURSE: Introduction to Environmental Technology.

UNIT: III: Public Water Supply.

LESSON: 6 of 10: Indicator Organisms.

Estimated time: 10 minutes.

Entering Competencies: The student must be able to define "bacteria."

Justification:

Objective: From memory, the student will list three prerequisites for an indicator organism and identify E. coli and Aerobacter aerogenes as the indicator organisms for drinking water.

Evaluation Activities:

Resources:

Instructional Approach:

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM: Environmental Technology.

COURSE: Introduction to Environmental Technology.

UNIT: IV: Chlorination.

LESSON: 5 of 10: Residual Chlorine.

Estimated time: 10-15 minutes.

Entering Competencies: The student must be able to list the characteristics of chlorine and identify the factors that affect chlorination.

Justification:

Objective: Given a graph showing residual chlorine on the y axis and chlorine dosaga on the x asis, the student will sketch the line showing chlorine addition to both distilled water and drinking water. On the graph, the following must be identified:

1. Chlorine combining with chemicals.
2. Combined chlorine residual.
3. Breakpoint.
4. Free chlorine residual.

Evaluation Activities:

Resources:

Instructional Approach:

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM: Environmental Technology.

COURSE: Introduction to Environmental Technology.

UNIT: V: Introduction to Wastewater.

LESSON: 1 of 10: Flow Patterns.

Estimated time: 10-15 minutes.

Entering Competencies: None.

Justification:

Objective: Given the names of various process units found in a trickling filter and an activated sludge plant, the student will arrange them in a normal flow pattern, to an accuracy of 90 percent.

Evaluation Activities:

Resources:

Instructional Approach:

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM: Environmental Technology.

COURSE: Introduction to Environmental Technology.

UNIT: VI: Introduction to Solid Waste.

LESSON: 1 of 10: Decomposition.

Estimated time: 10-25 minutes.

Entering Competencies: None.

Justification:

Objective: From memory, the student will describe the decomposition process. Included in the discussion must be the following:

1. Three products of decomposition.
2. One problem resulting from decomposition.
3. The solution to that problem.

Evaluation Activities:

Resources:

Instructional Approach:

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM: Environmental Technology.

COURSE: Introduction to Environmental Technology.

UNIT: VII: Introduction to Air Pollution.

LESSON: 1 of 10: Air Pollutants.

Estimated time: 10-15 minutes.

Entering Competencies: None.

Justification:

Objective: From memory, the student will list five of the seven air pollutants for which control laws have been written.

Evaluation Activities:

Resources:

Instructional Approach:

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM:

COURSE:

UNIT:

LESSON:

Estimated time:

Entering Competencies:

Justification:

Objective:

Evaluation Activities:

Resources:

Instructional Approach:

UNIT ELEVEN
PRESENTATIONS - Unit Overview

Overview:

This unit is intended as an application of the basic instructional technology subjects covered in this workshop. It provides an opportunity for particiants to practice their presentation skills. (The content, objectives, Instructional Package Worksheets, and support materials for teaching this unit are developed by workshop participants as part of Unit Ten's activities.)

Objective:

The participant will practice presentation skills and use rating scales to evaluate the presentations of other participants.

Resources:

-Unit Ten materials
-Presentation Rating Scales (Six for each participant provided by instructor)

UNIT TWELVE
REVIEW AND CONCLUSION - Unit Overview

Estimated time: 30-90 minutes

Overview:

As the conclusion to the workshop, this unit provides review for participants and an opportunity to receive feedback on their understanding of the major subject areas. Participants are also asked to provide the instructor with feedback on the strengths and weaknesses of the workshop itself.

Objective:

Participants will describe the purpose of this workshop during discussion. Participants will also complete a workshop evaluation.

Resources:

-Workshop Evaluation Form

UNIT TWELVE: REVIEW AND CONCLUSION
LESSON 1 of 1: EVALUATION

BASIC INSTRUCTIONAL TECHNOLOGY
EVALUATION FORM

Date: ______________________ Instructor: ______________________

Directions:

Check the most appropriate response to each of the following items.

1. Of the objectives covered, I can successfully perform:

   ( ) All of them.
   ( ) Some of them.
   ( ) None of them.

2. The objectives were covered:

   ( ) Too quickly.
   ( ) Just right.
   ( ) Too slowly.

3. In preparing for instruction in the future, the objectives covered were:

   ( ) Important.
   ( ) "Nice to know" but not important.
   ( ) Irrelevant.

4. The tests and assignments were directly related to the stated objectives:

   ( ) All of the time.
   ( ) Some of the time.
   ( ) Very little of the time.

5. Given my previous background in this subject, most of the material was:

   ( ) Too advanced.
   ( ) Just right.
   ( ) Too basic.

6. Overall, I would rate this training activity as:

   ( ) Excellent.
   ( ) Fair.
   ( ) Poor.

7. Reading materials used in lessons were:

( ) Too difficult for my ability.
( ) Appropriate for my ability.
( ) Too elementary for my ability.

8. I can report my feelings about the training experience as:

( ) Enjoyable.
( ) Alright.
( ) Unpleasant.

ADDENDUM A

References and Glossary

REFERENCES

UNIT ONE

Mager, R. F. and K. M. Beach, Jr. "Developing Vocational Instruction." Belmont, CA: Fearon Publishers, 1967.

Popham, W. J. and E. L. Baker. "Systematic Instruction." Englewood Cliffs, NJ: Prentice-Hall, Inc., 1970.

UNIT TWO

None

UNIT THREE

Harless, J. H. "An Ounce of Analysis (is Worth a Pound of Objectives)." Mclean, VA: Harless Performance Guild, Inc., 1975.

Mager, R. F. and P. Pipe. "Analyzing Performance Problems (or 'You Really Oughta Wanna')." Belmont CA: Fearon Publishers, 1970.

UNIT FOUR

Mager, R. F. and K. M. Beach, Jr. "Developing Vocational Instruction." Belmont, CA: Fearon Publishers, 1967.

UNIT FIVE

Gronlund, N. E. "Stating Behavioral Objectives for Classroom Instruction." New York: Macmillan, 1970.

Mager, R. F. "Preparing Instructional Objectives." Belmont, CA: Fearon Publishers, 1962.

UNIT SIX

Butler, E. C. "Instructional Systems Development for Vocational and Technical Training." Englewood Cliffs, NJ: Educational Technology, 1972.

Gronlund, N. E. "Preparing Criterion-Referenced Tests for Classroom Instruction." New York: Macmillan, 1973.

Popham, W. J. "Criterion-Referenced Measurement." Englewood Cliffs, NJ: Prentice-Hall, Inc., 1978.

Popham, W. J. and E. L. Baker. "Systematic Instruction." Englewood Cliffs, NJ: Prentice-Hall, Inc., 1970.

UNIT SEVEN

Gagne, R. M. and Briggs, L. J. "Pinciples of Instructional Design." New York: Holt, Rinehart, and Winston, 1974.

Gerlach, V. S. and Ely, D. P. "Teaching and Media: A Systematic Approach." Englewood Cliffs, NJ: Prentice-Hall, Inc., 1970.

Popham, W. J. and Baker, E. L. "Systematic Instruction." Englewood Cliffs, NJ: Prentice-Hall, Inc., 1970.

UNIT EIGHT

Bolles, (unk) "The Three Boxes of Life." Ten Speed Press.

"How to Teach Grown-ups." Practical Management Associates Inc., Workbook #4.

Kemp, J. E. "Planning and Producing Audio-Visual Materials." New York: Crowell, 1975.

McCoy, James T. "The Management of Time." Englewood Cliffs, NJ: Prentice-Hall, Inc.

Merrill, M. D. and Goodman, R. I. "Selecting Instructional Strategies and Media: A Plan to Begin." Provo, UT: National Special Media Institutes, 1972.

Science News (periodical), April 3, 1976.

Training (periodical). "Adult Learning in Your Classroom." January 1978.

Wilson, Marlene. "Survival Skills for Managers." Volunteer Management Associates.

UNIT NINE

Popham, W. J. and Baker, E. L. "Systematic Instruction." Englewood Cliffs, NJ: Prentice-Hall, Inc., 1970.

UNIT TEN

None

UNIT ELEVEN

None

UNIT TWELVE

None

GLOSSARY

Affective Behavior - expressions of feeling or interest; the adoption of an attitude or belief; the motivation to do something.

Check List - a list of skills or tasks which the trainee is expected to demonstrate in the satisfactory performance of a job, behavior, etc.

Cognitive Behavior - actions which involve knowing, understanding or applying information; remembering or using facts or ideas.

Demonstration - showing, as opposed to telling, how to do something by manipulating appropriate materials and equipment.

Entering Competencies - skills and knowledge that trainees must possess before they are ready to learn the behavior specified in the objective.

Evaluation - the systematic process of collecting, analyzing, and preparing information for the purposes of decision-making. The functions of evaluation in training programs are to determine existing capabilities of employees, to provide feedback to trainees, to practice using a new skill and to determine (or certify) the preparation of a trainee to do a particular job.

Guided Discussion - a sharing of ideas and opinions in order to arrive at a mutually acceptable decision or solution to a problem.

Individualized Instruction - a means of bringing instruction under some aspect of learner control.

Instruction - external conditions arranged to help the student learn.

Instructional Activities - activities an instructor plans and arranges to help students learn.

Instructional Approach - the sequence of activities which an instructor uses to teach a lesson.

Instructional Design - the systematic process of specifying the goals and means of instruction. Included are the stages of objectives specification, evaluation design, method selection, and lesson planning.

Instructional Method - how content is taught.

Instructional Objective - a statement that describes an intended outcome of instruction in terms of learner behavior. It describes what a specific group or class of students should be able to do under specific conditions and how well it must be done.

Instructional Strategy - a prescriptive statement identifying the most appropriate instructional methods and learning activities for a specific type of desired performance.

IPW (Instructional Package Worksheet) - describes in detail and in order what must be done in order to teach a single objective.

IRIS (Instructional Resources Information System) - is an automated information system managed by EPA Instructional Resources Center which acquires, reviews, indexes and announces both print and non-print instructional materials.

Job - the occupational title or position held by an employee.

Job Description - a statement outlining areas of responsibility (duties) of a given position.

Learning - involves a more or less permanent change in the ability of the person to do something not previously possible.

Learning Activities - things learners do to help them learn.

Lecture - uninterrupted speech by which one presents information to others.

Lesson - instruction which (usually) encompasses a single instructional objective. A set of lessons on related objectives comprise a unit or a module of a unit.

Media - means or methods of presenting information aurally and/or visually.

Medium of Instruction - a channel of communication through which instruction is presented to the learner.

Motivation - the process of directing, focusing, and energizing behavior toward the accomplishment of specific goals.

Problem - a discrepancy of deficiency between the way things are and the way things ought to be.

Psychomotor Behavior - physical actions, speed or agility; the performance of a particular body movement.

Rating Scale - a list of skills or tasks, but with each so carefully defined as to permit the evaluator to judge the relative quality of the performance.

Resources - anything an instructor or trainee uses during instruction as a resource.

Task - is one of the skills or operations which belong to a specific duty or area of responsibility. Each task usually consists of specific and distinct steps for its completion.

Task Analysis - the act of dividing a duty into all of its components. It results in a list of everything an employee must do to advance the work to completion.

Unit - instruction on a set of related objectives, each of which is taught in a single lesson.

ADDENDUM B

Other U.S. Environmental Protection Agency Instructional Support Services and Materials

INSTRUCTIONAL RESOURCES CENTER

The U.S. EPA maintains an Instructional Resources Center in Columbus, Ohio. A primary objective is the compilation and dissemination of information about water quality and pesticide instructional materials available to interested persons. The "Instructional Resources Center Bulletin" is designed as the communications link between the Center and persons involved in environmental education and training. If you wish to receive free copies of the annual bulletin, send your name, position title, organization or institution or agency name, mailing address and phone number to:

IRC Bulletin
The Ohio State University
1200 Chambers Road
Columbus, Ohio 43212

INSTRUCTIONAL MATERIALS CATALOG

Several audiovisual units and course packages are available for rent from U.S. EPA, the "Water Quality Control Instructional Materials" catalog describes slide/tape units, 16mm films, videocassettes and course packages that can be borrowed. If you wish to obtain copies of catalogs, please send address information to:

Instructional Resources Center
The Ohio State University
1200 Chambers Road
Columbus, Ohio 43212

INSTRUCTIONAL RESOURCES INFORMATION SYSTEM

The Instructional Resources Information System (IRIS) is a computer-based information system. It currently lists information about 10,000 printed or audiovisual water quality and pesticide instructional resources available from various individuals, state and federal government agencies, educational institutions and commercial companies throughout the country. For more information about this system, write to:

U.S. EPA Instructional Resources Center
The Ohio State University
1200 Chambers Road
Columbus, Ohio 43212

INSTRUCTIONAL SUPPORT PACKAGES
for
TRAINING ENVIRONMENTAL PROFESSIONALS

The U.S. EPA has developed instructional packages for several technical courses of interest to water, wastewater and land management personnel. Each package consists of a course manual, a staff guide and visual or audiovisual instructional aids for each topic. The printed manual are available through EPA's Instructional Resource Information System (IRIS) and/or the National Technical Information Service (NTIS). Instructional aids for teaching the topics are available for purchase from the EPA IRC.

Following is a description of the courses for which instructional packages are currently available. The format of the manuals facilitates selection and presentation of those topics of interest to a particular student or group of students.

For more information about purchasing any of these materials, contact:

EPA Instructional Resources Center
The Ohio State University
1200 Chambers Road
Columbus, Ohio 43212

Self-Monitoring Procedures: Basic Laboratory Skills

For:

Treatment plant personnel who are required to monitor effluent discharges and who have had little or no previous experience in laboratory work.

Topics:

Review of basic mathematics including the metric system, formulas and percentage; basic chemical laboratory operations such as weighing techniques, use of equipment and preparation of reagents; basic microbiological laboratory operations. Emphasis is on practice of skills.

Time:

Seventeen lessons ranging from 0.5 to 3.0 hours. Total instruction time is about 38 hours.

Effluent Monitoring Procedures: Basic Parameters for Municipal Wastewaters

For:

Municipal treatment plant personnel who are required to sample, measure and analyze their discharges and who have had little or no previous experience in laboratory work.

Topics:

Open Channel Flow Measurement, Biochemical Oxygen Demand, Dissolved Oxygen, pH, Fecal Coliform by MPN and MF methods, Total Residual Chlorine, Suspended and Settleable Solids, Reporting Data. Emphasis is on laboratory practice.

Time:

Eighteen lessons ranging from 0.5 to 7.5 hours. Total instruction time is 30 to 45 hours.

Effluent Monitoring Procedures: Metals Analysis

For:

Municipal treatment plant personnel who are responsible for performing metal analysis and have had little or no experience in laboratory work.

Topics:

Various metals are used as examples of six methods used to determine metals: Boron, colorimetry; Calcium, volumetric; Copper, Magnesium, Manganese, Zinc, direct aspiration atomic absorption; Lead, extraction followed by atomic absorption; Mercury, flameless atomic absorption; Potassium and Sodium, flame photometry. Emphasis is on laboratory practice.

Time:

Seven lessons ranging from 2.5 to 5 hours. Total instruction time is 20 to 23 hours.

Effluent Monitoring Procedures: Nutrients

For:

Municipal treatment plant personnel who are responsible for performing nutrient analyses and who have had little or no experience in laboratory work.

Topics:

Phosphorus, Kjeldahl Nitrogen, Ammonia, Organic Nitrogen (by difference), Nitrate and Nitrite Nitrogen by Cadmium Reduction. Also Chemical Oxygen Demand and Oil and Grease. Emphasis is on laboratory practice.

Time:

Nine lessons ranging form 1.0 to 7.0 hours. Total instruction time is 27 to 33.5 hours.

Methods for Determination of Chemical Contaminates in Drinking Water

For:

Chemists and technicians with little or no experience in chemical procedures required to monitor drinking water.

Topics:

Sampling, Statistics, Quality Control, Safety, Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver, Fluoride, Nitrate, Organics (chlorinate hydrocarbons, chlorophenoxys, trihalomethanes), Chlorine and Turbidity. Representative methods can be selected for the laboratory practice sessions.

Time:

Fourteen lessons ranging from 1.0 to 3.8 hours. Total instruction time is 26 to 49 hours.

Determination of Residual Chlorine and Turbidity in Drinking Water

For:

Chemists and technicians with little or no experience in chemical procedures required to monitor drinking water.

Topics:

Compliance Requirements, Total Residual Chlorine and Turbidity. Emphasis is on laboratory practice.

Time:

Five lessons ranging from 0.75 to 1.5 hours. Total instruction time is 5 hours.

Inorganic Analyses in Water Quality Control Programs

For:

Chemists and technicians with chemical laboratory experience, 1 year experience, 1 year of college level inorganic chemistry and 1 semester of quantitative analysis (or equivalent).

Topics:

Sample Handling, Compliance Methodology, Safety, Analytical Techniques, Volumetric Analyses, Precision, Accuracy, Quality Assurance Programs, Acidity and Alkalinity, Total Residual Chlorine, Fluoride, Hardness, Nitrate and Nitrite Nitrogen, Total Phosphorus, Total and Suspended Solids, Specific Conductance, Turbidity. Emphasis is on laboratory practice.

Time:

Nineteen lessons ranging from 0.5 to 5.25 hours. Total instruction time is 30 hours.

Organic Analysis in Water Quality Control Programs

For:

Chemists and technicians with chemical laboratory experience, 1 year of college level organic chemistry and 1 semester of quantitative analysis (or equivalent).

Topics:

Sample Handling, Compliance Methodology, Safety, Control of Analytical Performance, Spectrophotometer and Calibration Graphs, Gas Chromatography, Dissolved Oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand, Chlorinated Hydrocarbons, Total Organic Carbon, Total Kjeldahl and Organic Nitrogen, Oil and Grease, Phenolics, Polychlorinated Biphenyls, Surfactants. Emphasis is on laboratory practice.

Time: Twenty-one lessons ranging from 0.5 to 5.25 hours. Total instruction time is 26 to 30 hours.

Bacteriological Methods in Water Quality Control Programs

For:

Bacteriologists and technicians with bacteriological laboratory experience including sample innoculations, transfers, media preparation and handling, and related skills.

Topics:

Compliance Methodology; Chlorine Determinations and Turbidity; Bacterial Indicators; Equipment, Media and Solutions, Sample Volumes, Sample Collection and Test Procedures for both the MPN and MF methods; Statistics and Geometric Means. Emphasis is on laboratory practice.

Time:

Twenty-one lessons ranging from 0.75 to 4.0 hours. Total instruction time is 28.75 hours.

Land Application of Wastes

For:

Engineers, scientists, waste management specialists and other professionals with at least the equivalent of an undergraduate degree in engineering, agriculture or a related discipline.

Topics:

Course integrates pertinent information from sanitary and environmental engineering, agronomy, soil science, agricultural engineering, economics, and law as applicable to utilizing land for the application of various types of wastes. Lessons are: Soil as a Treatment Medium, Site Evaluation Procedures, Design Approaches, Social Factors, Vegetative Cover, Alternative Systems, Monitoring, Nitrogen Management, Phosphorus Management, Toxic Element Interactions, Organics, Legal Aspects, Crop Selection, Non-crop Uses, Costing Procedure, Water Management and Climate Effects.

Time:

Twenty-one modules ranging from 0.5 to 3.0 hours. Designed for a workshop setting of about 40 hour duration.

Note: Materials were developed by a grantee.

Erosion and Sediment Control, Audiovisual Training Program

For:

Those responsible for erosion and sediment control, management, inspections or State standard development or support.

Topics:

Erosion and sediment control, Soils, Rainfall-runoff relationships, Erosion and sedimentation, Plant materials, Control of runoff during construction, Vegetative soil stabilization, Stream erosion control, Temporary soil stabilization, Sediment from construction, Control planning, Wooded sites, Roles and responsibilities.

Time:

Thirteen modules, self-paced. The package is designed for both self-study and for group presentation.

Note: Materials were developed by a contractor.

CURRICULUM GUIDES

Curriculum guides for training water quality control personnel have been developed by various institutions and are available for use and adaption by others. For further information about the following, contact the source cited.

A Two-Year Water Quality Monitoring Curriculum

Source:

Ulster County Community College
Attn: Professor Richard Glazer's Office
Stone Ridge, New York 12484

Wastewater Technology: A Two-Year Post-High School Instructional Program

Source:

Charles County Community College
Attn: Mr. William Engel's Office
P.O. Box 910
La Plata, Maryland 20646

Wastewater Engineering Technology Program

Source:
Clemson University
Attn: Dr. Joseph Allen's Office
Clemson, South Carolina 29631

Note: This is a four year program.

Bachelor of Engineering Technology Curriculum in Water Quality Management

Source:
Pennsylvania State University
Attn: Dr. Charles Cole's Office
Capitol Campus, W 261
Middletown, Pennsylvania 17057

Note: This is a two plus two or a four year program.

ADDENDUM C

Blank Forms

INDEX TO BLANK FORMS

Task Detailing Sheet . . . . 1 page

Instructional Package Worksheet . . . . 1 page

Objectives Score Sheet . . . . 1 page

Presentation Rating Scale . . . . 1 page

TASK DETAILING SHEET

A. Write Job Title ____

B. Write Task ____

Complete steps C-F in the space below.

C. List the specific steps required to perform the task.

D. Check each step which needs to be taught.

E. Indicate whether the checked steps primarily involve cognitive, affective, or psychomotor behavior.

F. For a cognitive behavior, indicate the appropriate level of performance:

Knowledge - ability to recall information or procedures.

Comprehension - ability to explain information or procedures.

Application - ability to use information or procedures to do something.

Problem-Solving - ability to develop new information or procedures.

Steps Required to Perform Task	Needs to be Taught	Type of Behavior Cognitive, Affect tive, Psychomotor	Level of Cognitive Behavior: Know., Comp., Appl., P.S.
1.			
2.			
3.			
4.			
5.			
6.			

INSTRUCTONAL PACKAGE WORKSHEET

CURRICULUM:

COURSE:

UNIT:

LESSON:

Estimated time:

Entering Competencies:

Justification:

Objective:

Evaluation Activities:

Resources:

Instructional Approach:

OBJECTIVES SCORE SHEET

Rate the objectives written by another participant according to the outline below.

1. State the behavioral term used. ________________________________

   Explicit? ______ Yes ______ No

   A better term would be ________________________________

2. What are the conditions under which the behavior is to be performed?

   ____

   Are the conditions clearly understandable? ______Yes ______No

   Are they complete? ______Yes ______No

3. Is the level of acceptable performance given?

   ______ Yes ______No

   Write it here. ________________________________

   Does it demonstrate that the student has mastered the objective?

   ______ Yes ______No

A - Five "yes" answers - excellent

B - Three or four "yes" answers - on the right track; need practice.

C - Two or less "yes" answers - unsatisfactory; reread training material.

PRESENTATION RATING SCALE

Speaker ______________________ Topic ___________________________

Reviewer _____________________ Date ____________________________

This rating scale is designed to give the speaker an indication of the quality of his presentation skills. Circle the appropriate number that best represents your impression of this speaker's performance on each characteristic. Any comments which will help the speaker improve his performance in the future will be appreciated.

Presentation Rating Scale

	Good	Average	Poor
Organization			
-Clear introduction	3	2	1
-Logical organization	3	2	1
-Emphasized key points	3	2	1
-Allowed for student feedback	3	2	1
-Provided summary	3	2	1
Delivery Techniques			
-Sufficient volume	3	2	1
-Varied intonation and pace	3	2	1
-Showed interest in subject	3	2	1
-Relaxed posture	3	2	1
-No distracting mannerisms	3	2	1

If distracting mannerisms were used, what were they?

____

Any general comments which might help the speaker improve his presentation ability in the future may be made below.